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Billings

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(54) **SWITCH TERMINAL SYSTEM WITH THIRD PARTY ACCESS**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

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Related U.S. Application Data

(63) Continuation-in-part of application No. 16/004,341, filed on Jun. 8, 2018, which is a continuation-in-part of application No. 16/003,142, filed on Jun. 8, 2018, which is a continuation-in-part of application No. 15/940,978, filed on Mar. 30, 2018, now Pat. No. 10,254,722, which is a continuation-in-part of application No. 15/933,611, filed on Mar. 23, 2018, which is a continuation of application No. 15/924,

(Continued)

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G05B 13/02 (2006.01)
G06N 99/00 (2019.01)
G06N 20/00 (2019.01)
G05B 13/04 (2006.01)

(52) **U.S. Cl.**

CPC **G05B 13/024** (2013.01); **G06N 20/00** (2019.01); **G05B 13/048** (2013.01)

(58) **Field of Classification Search**

None

See application file for complete search history.

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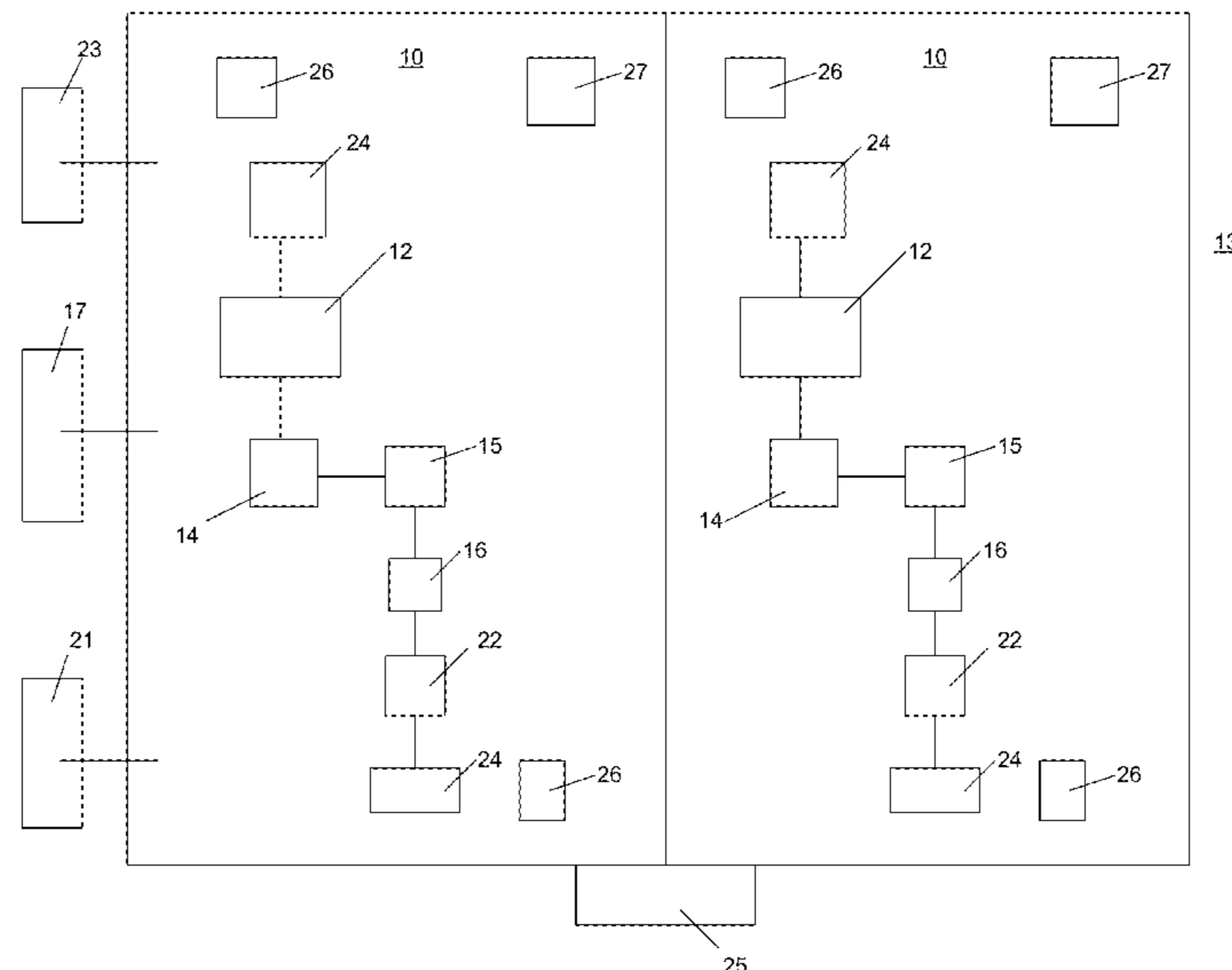
Primary Examiner — Ramesh B Patel

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(57) **ABSTRACT**

A system is provided for controlling a first switch terminal of a building occupied by one or more building occupant. The system includes a plurality of switch terminals at the building. A first computer system is coupled to the first switch terminal or equivalent of the building at a first location of the building. The first computer system runs on at least one platform. A first plurality of sensors is coupled to the first switch terminal and the first computer system. At least a portion of the sensors provide signal data to the first computer system. The first computer system produces a command or data output that relates to at least one of: a command output for a local control system, a command output for a different system, a data output for a different system, a command output for a non-local device or a data output that is a non-local device. A second switch terminal includes a second plurality of sensors coupled to a second computer system. The system is configured to be coupled with an imaging module at the dwelling. In response to authorization by at least one building occupant the sensing module is configured to provide third party access to at least a portion of the building.

30 Claims, 41 Drawing Sheets



Related U.S. Application Data

177, filed on Mar. 17, 2018, which is a continuation of application No. 15/907,273, filed on Feb. 27, 2018, now Pat. No. 10,146,191, which is a continuation-in-part of application No. 15/838,371, filed on Dec. 12, 2017, which is a continuation of application No. 15/835,471, filed on Dec. 8, 2017, which is a continuation of application No. 15/835,460, filed on Dec. 8, 2017, which is a continuation of application No. 15/822,109, filed on Nov. 24, 2017, which is a continuation-in-part of application No. 15/817,318, filed on Nov. 20, 2017, which is a continuation of application No. 15/815,729, filed on Nov. 17, 2017, which is a continuation of application No. 15/788,823, filed on Oct. 20, 2017, and a continuation-in-part of application No. 15/782,864, filed on Oct. 13, 2017, now Pat. No. 10,241,477, which is a continuation-in-part of application No. 15/681,356, filed on Aug. 19, 2017, now Pat. No. 10,067,484, which is a continuation-in-part of application No. 15/681,351, filed on Aug. 19, 2017, which is a continuation-in-part of application No. 15/681,343, filed on Aug. 19, 2017, which is a continuation-in-part of application No. 15/649,683, filed on Jul. 14, 2017, which is a continuation of application No. 15/649,672, filed on Jul. 14, 2017, which is a continuation of application No. 15/649,669, filed on Jul. 14, 2017, now Pat. No. 10,268,168.

(60) Provisional application No. 62/416,281, filed on Nov. 2, 2016.

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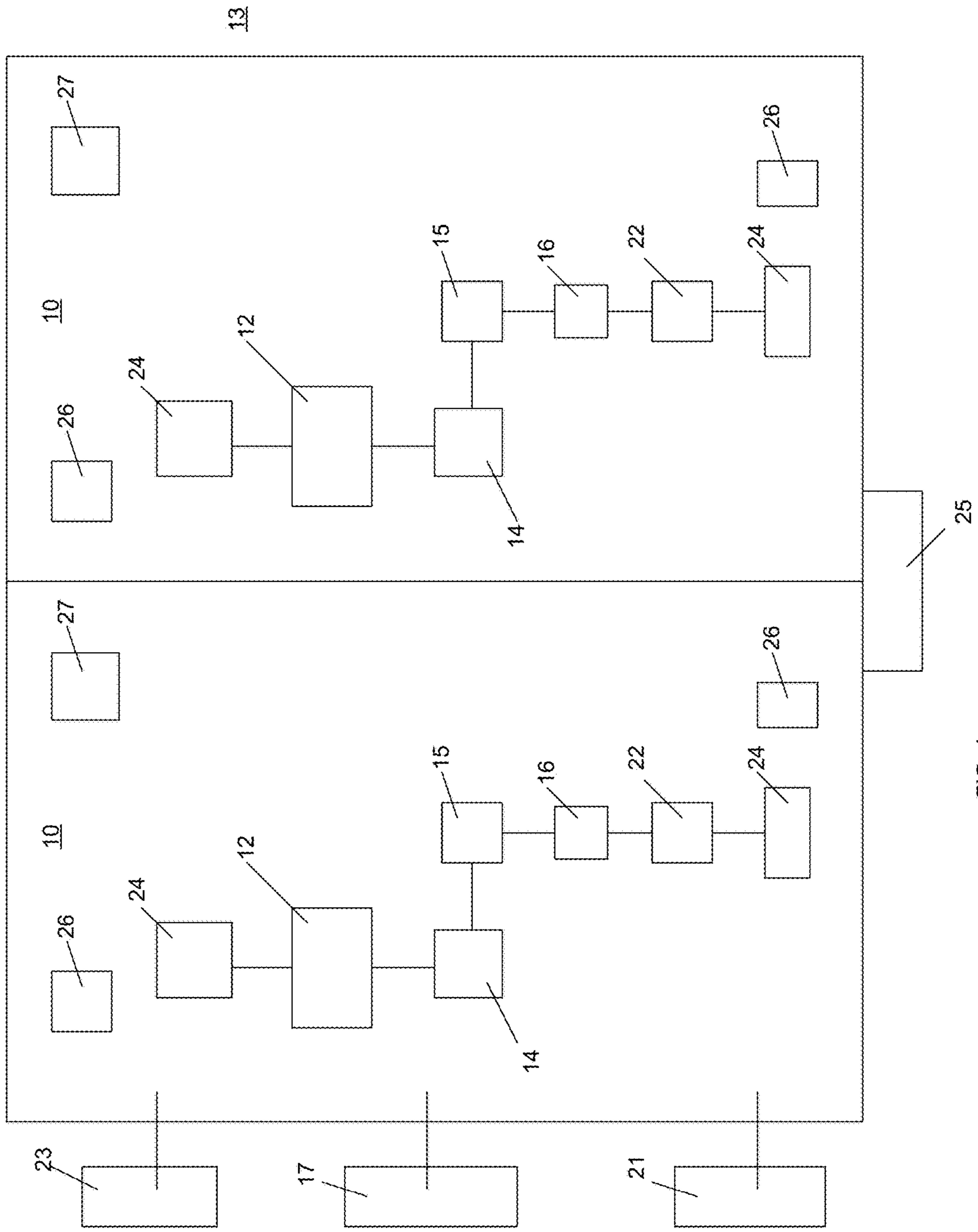


FIG. 1

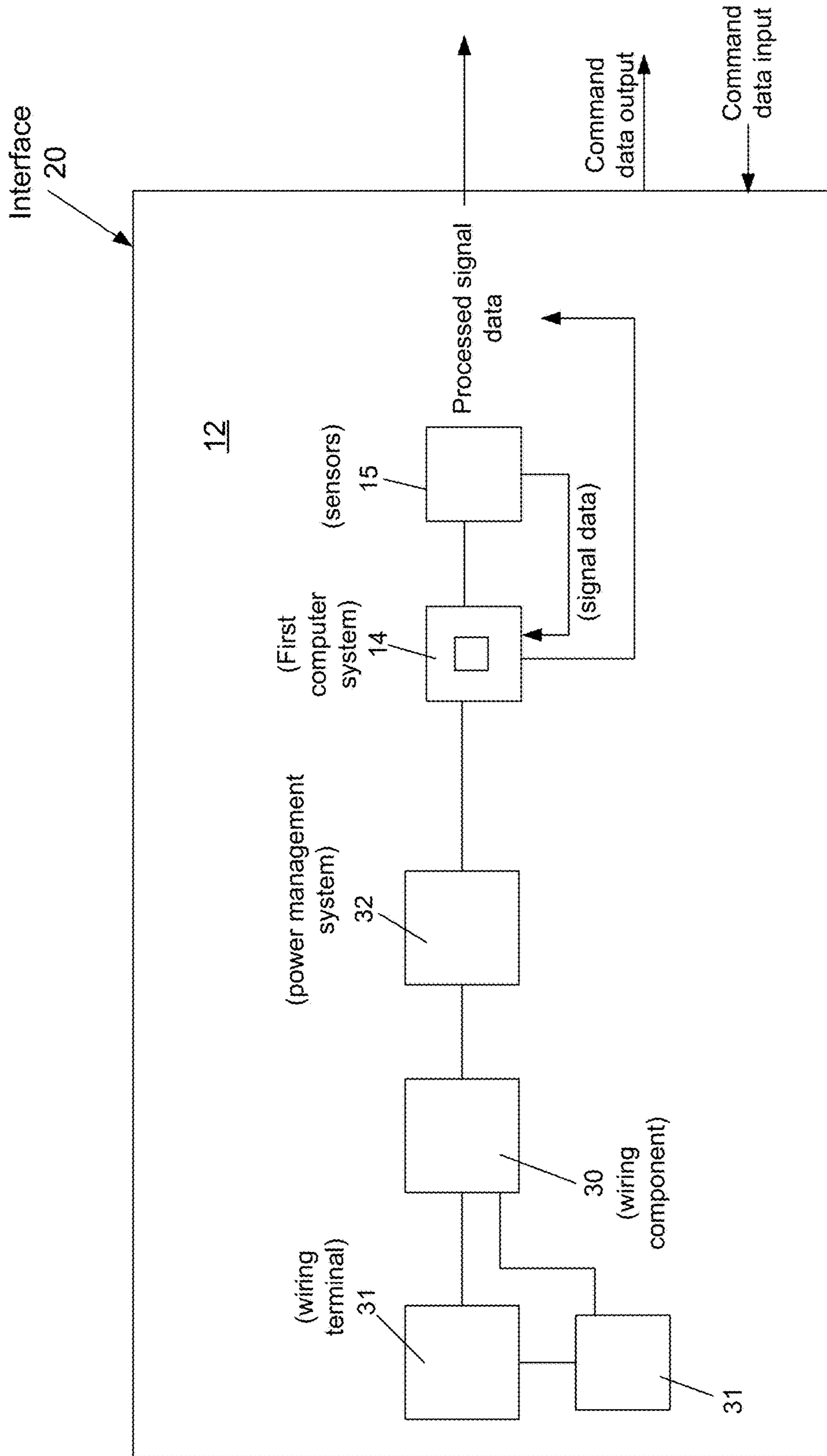


FIG. 2

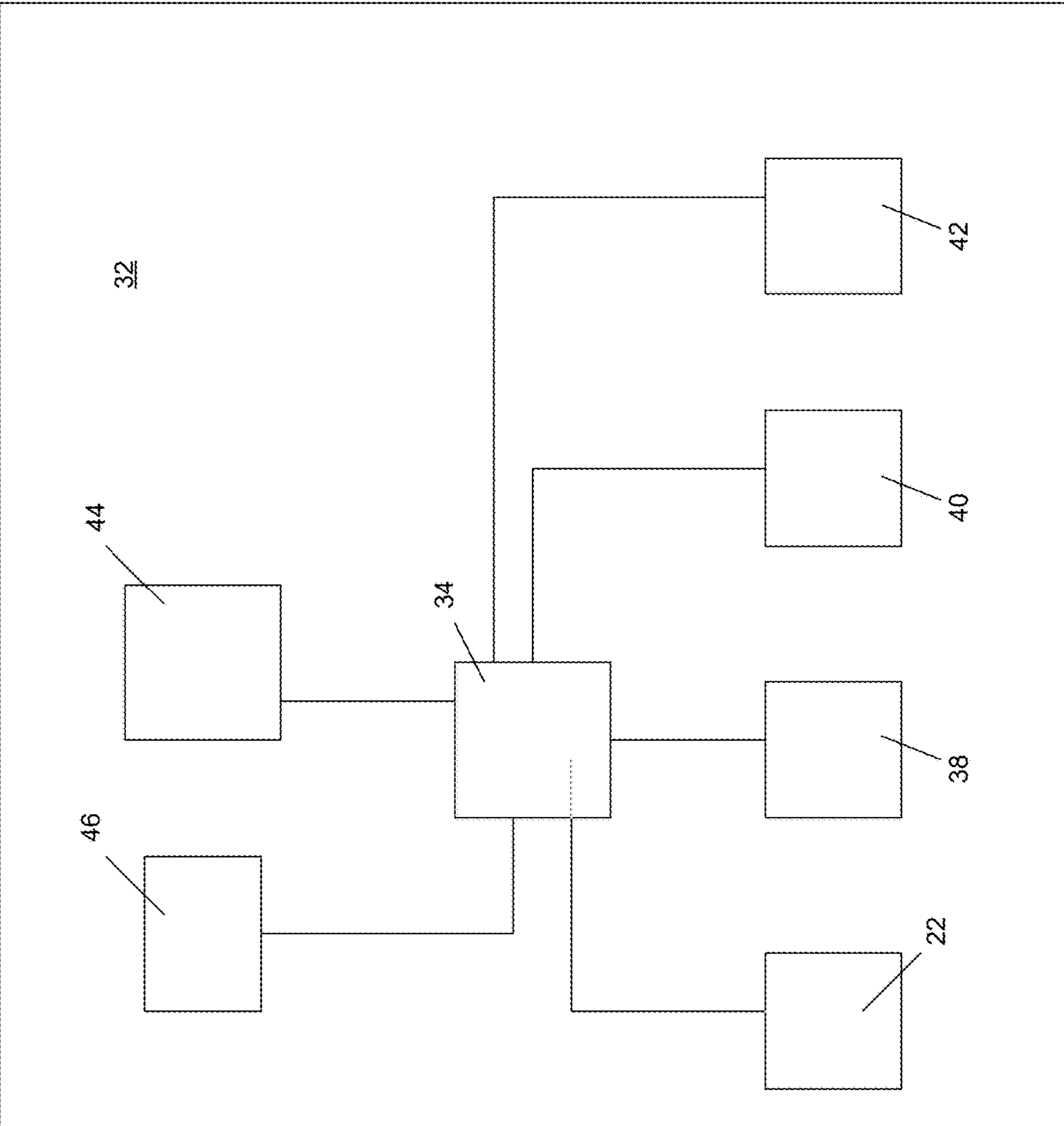


FIG. 3

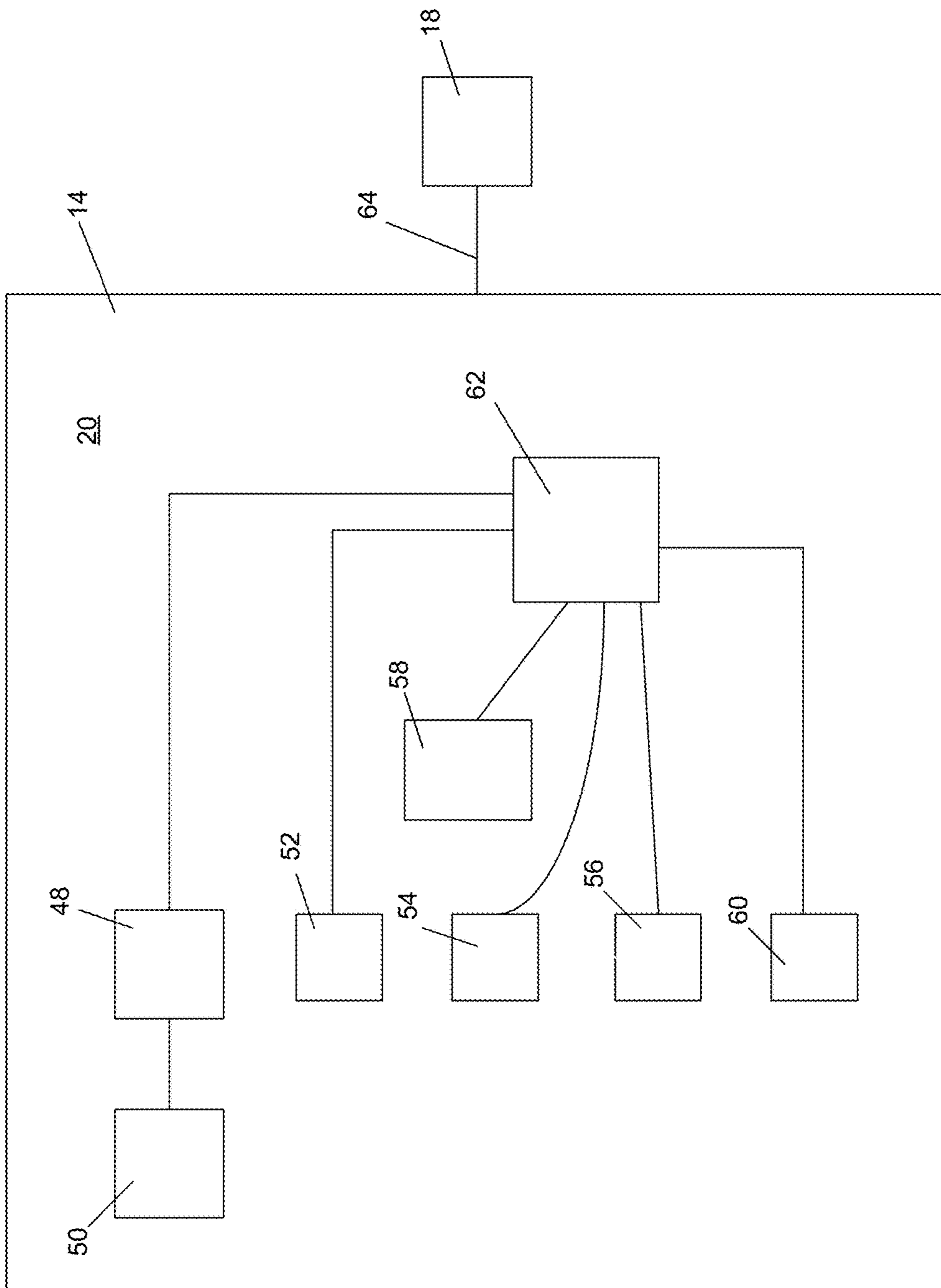


FIG. 4

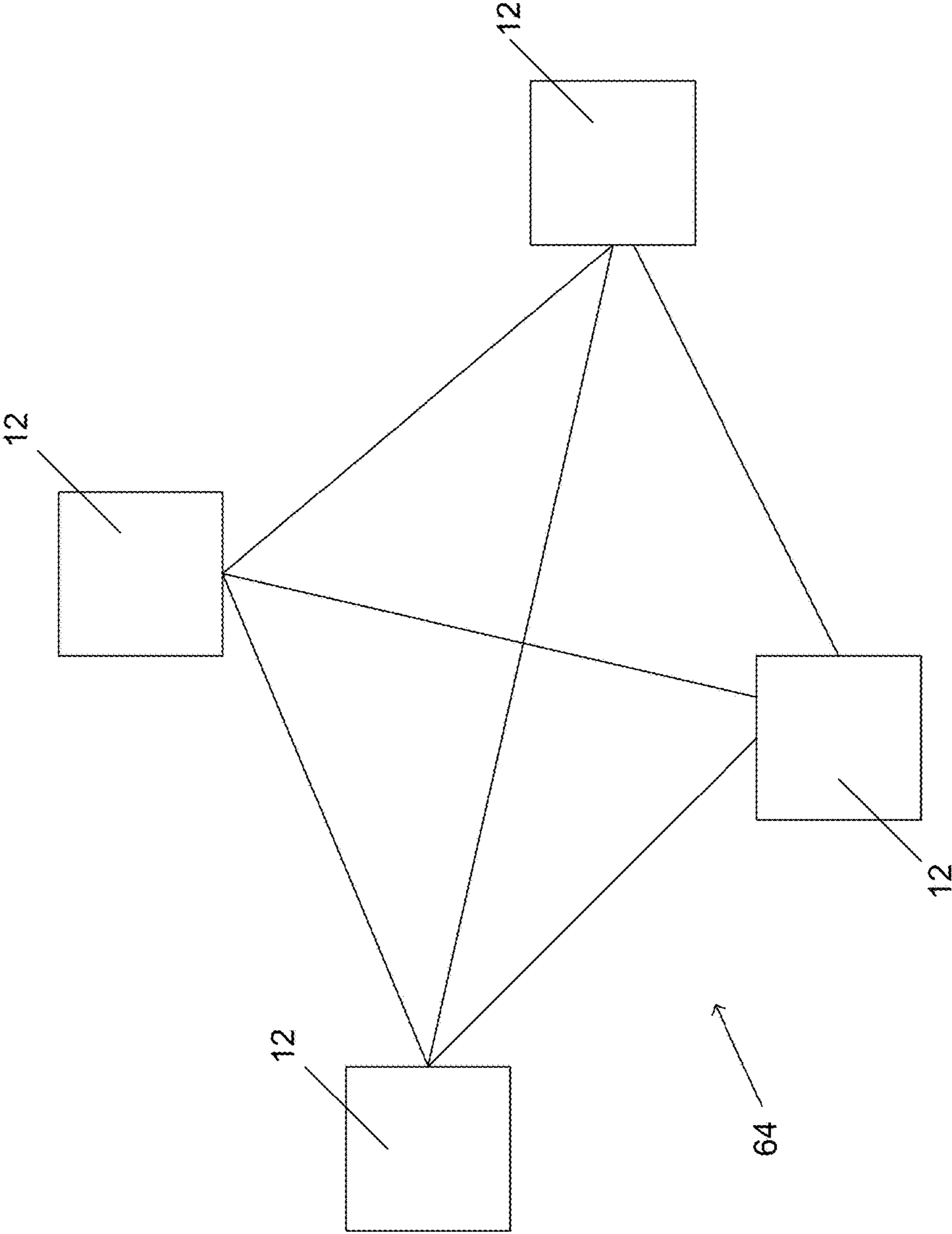


FIG. 5

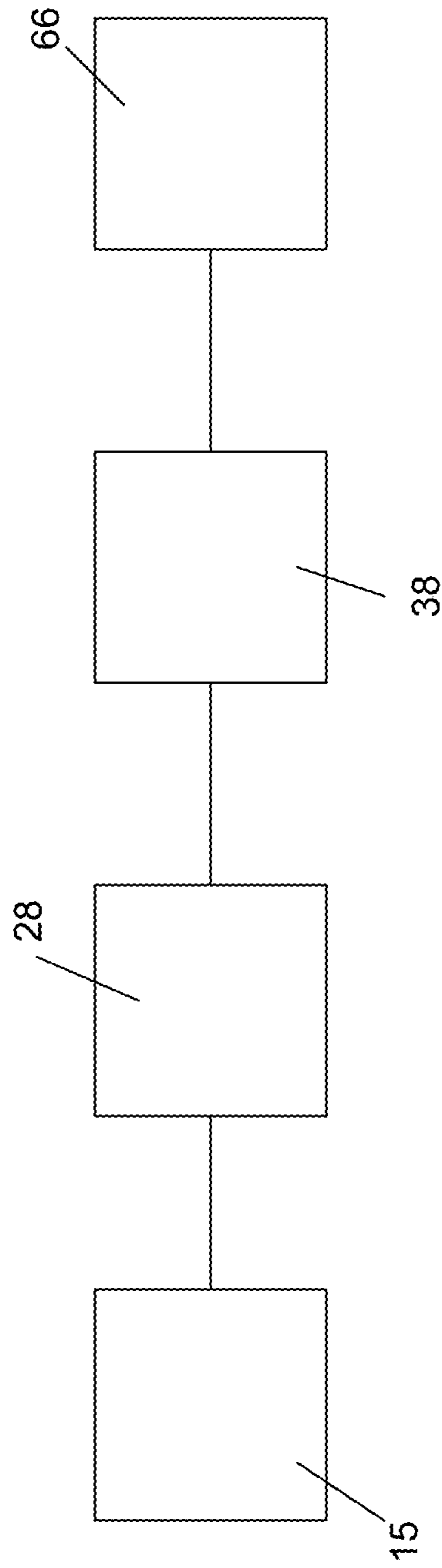


FIG. 6

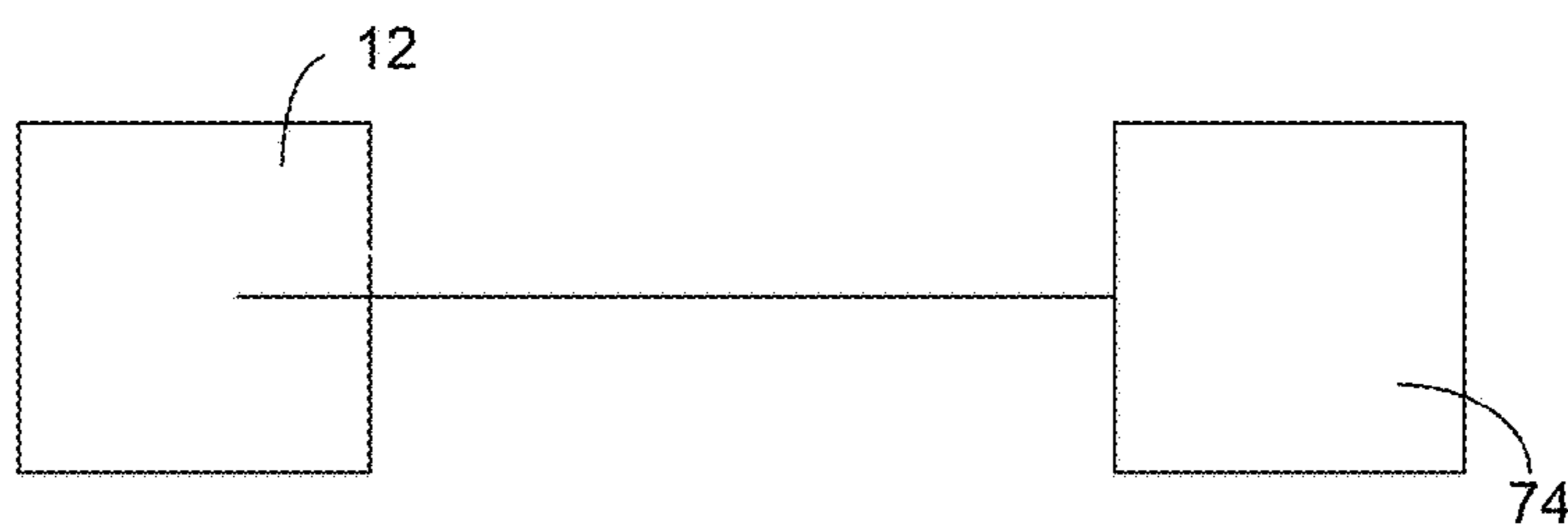


FIG. 7

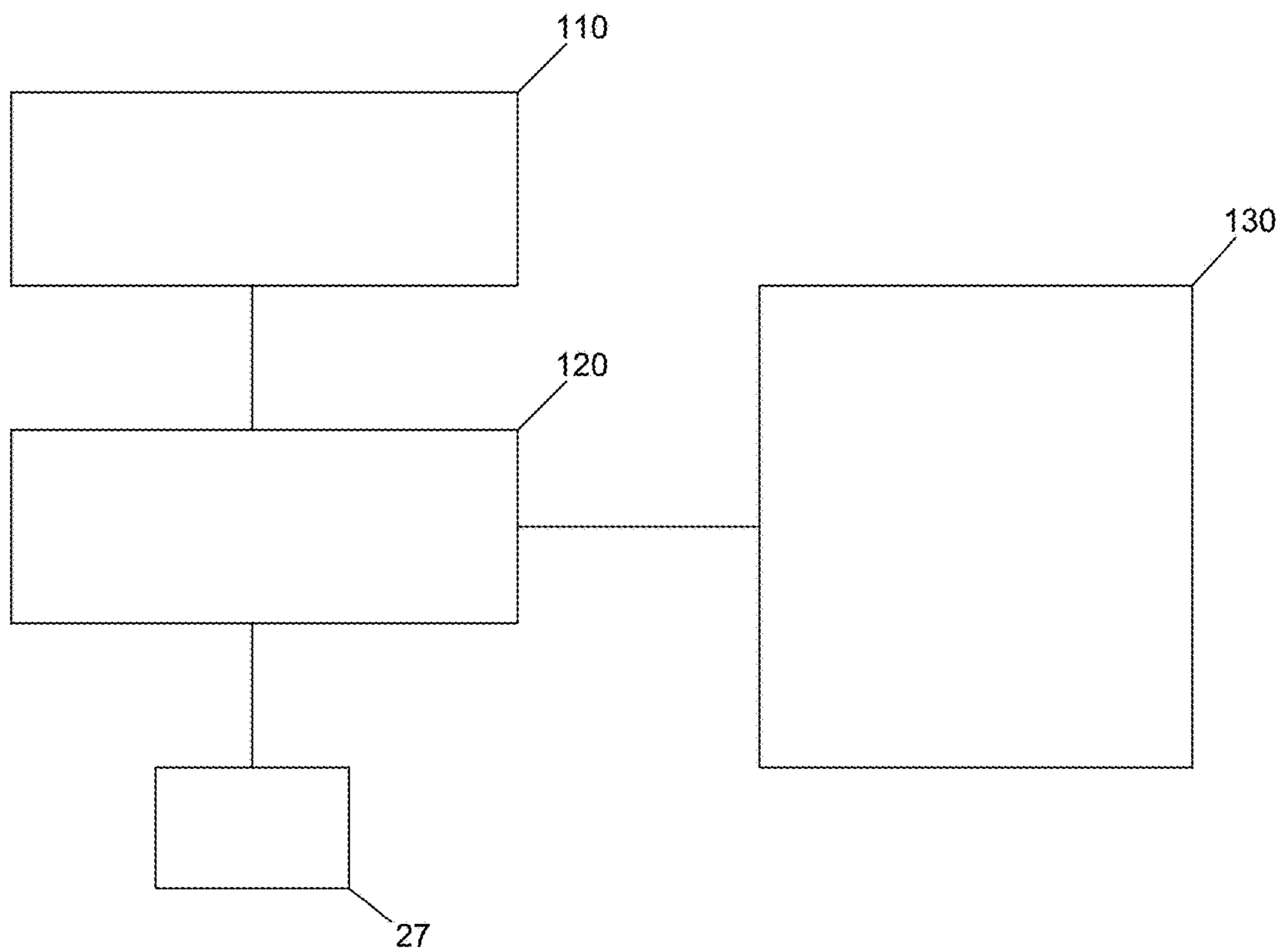


FIG. 8

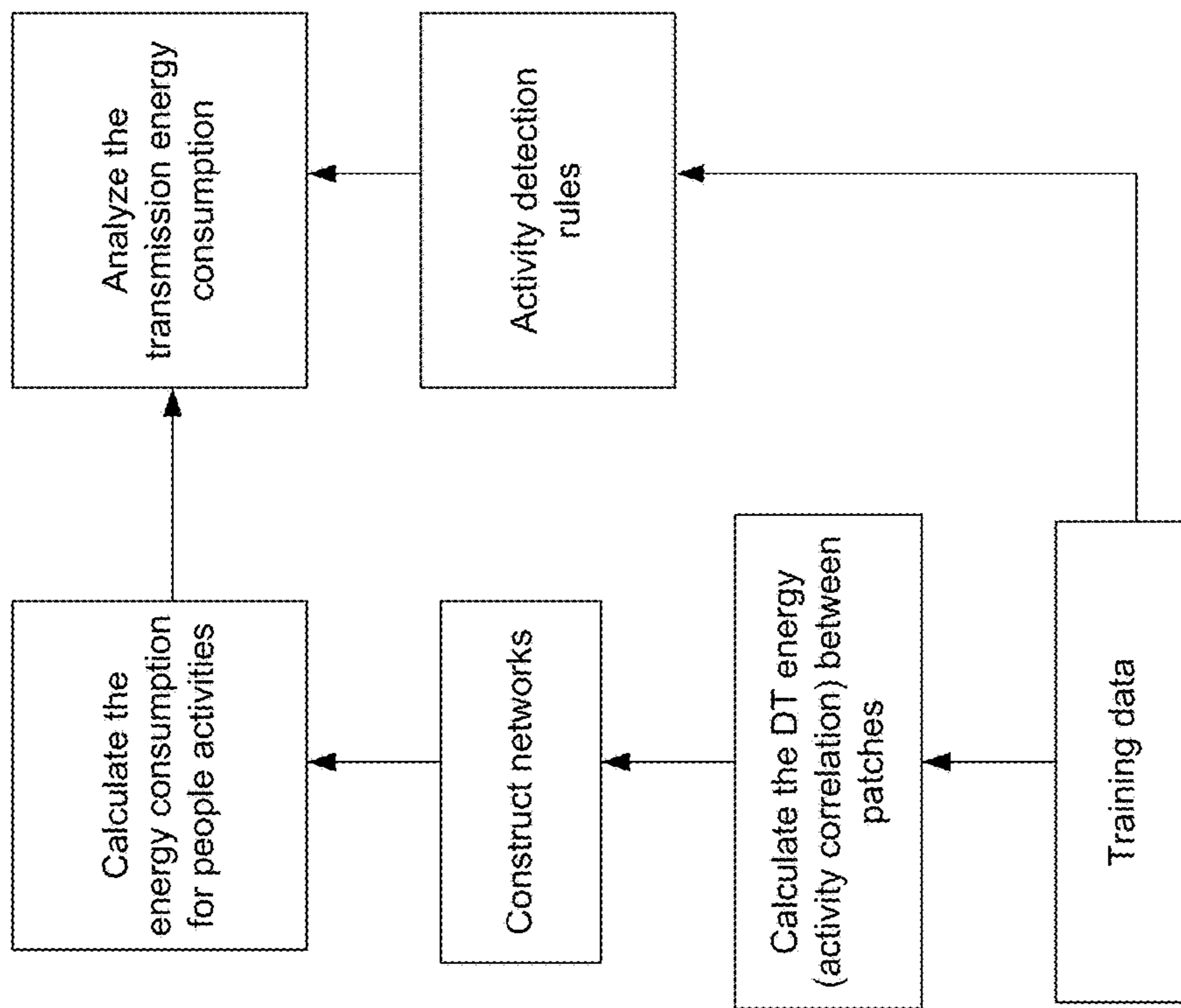


FIG. 9

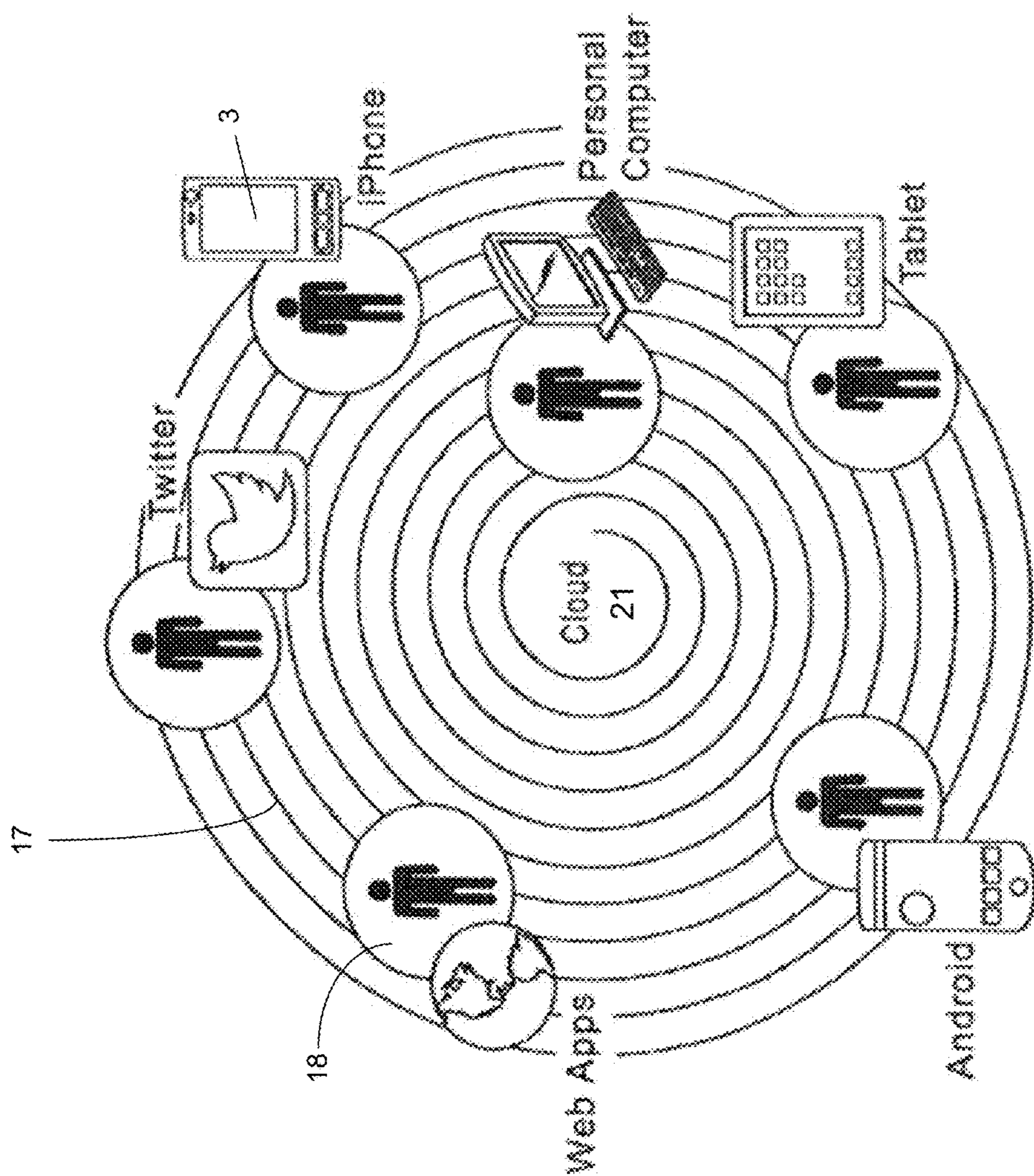


FIG. 10A

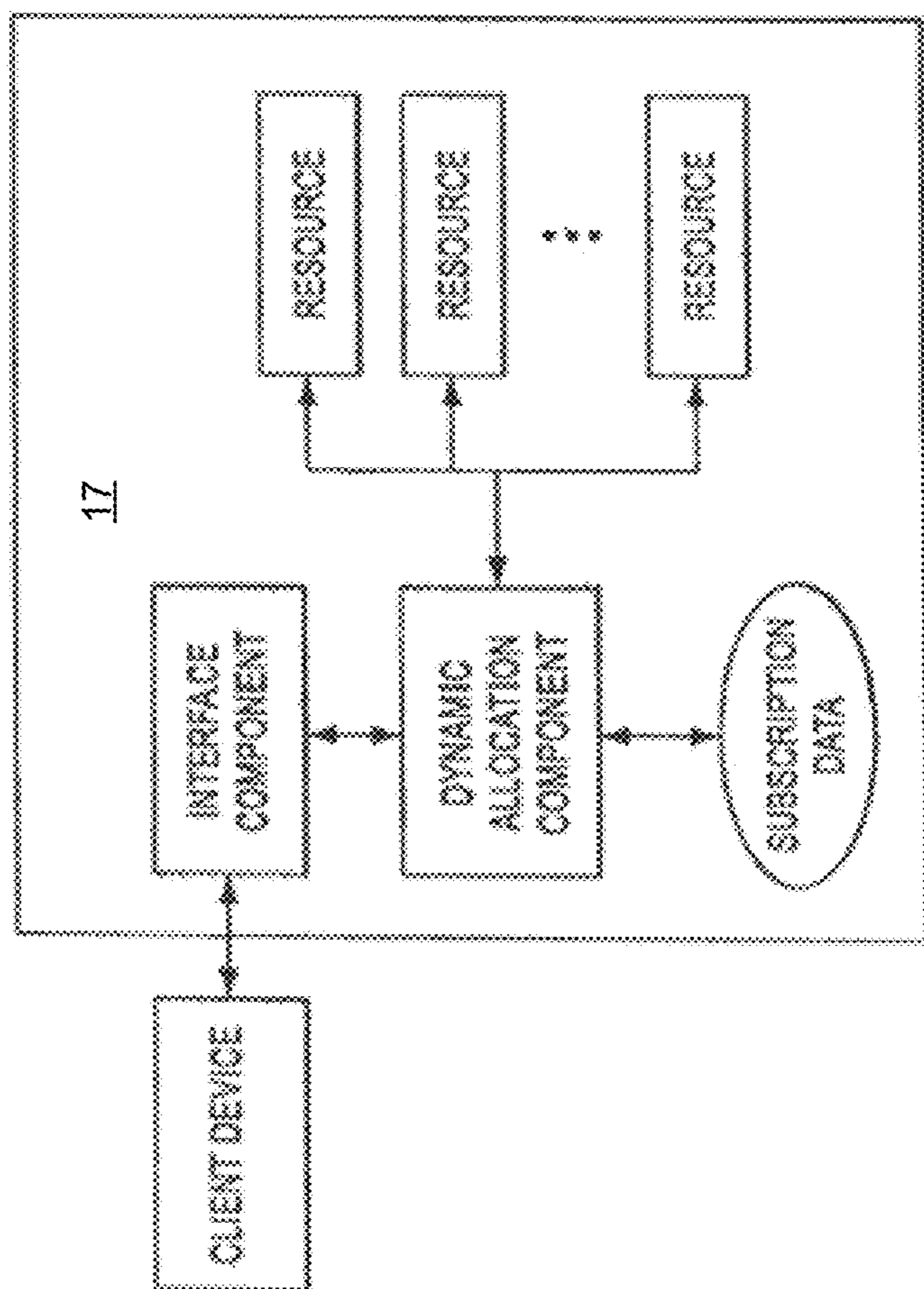


FIG. 10B

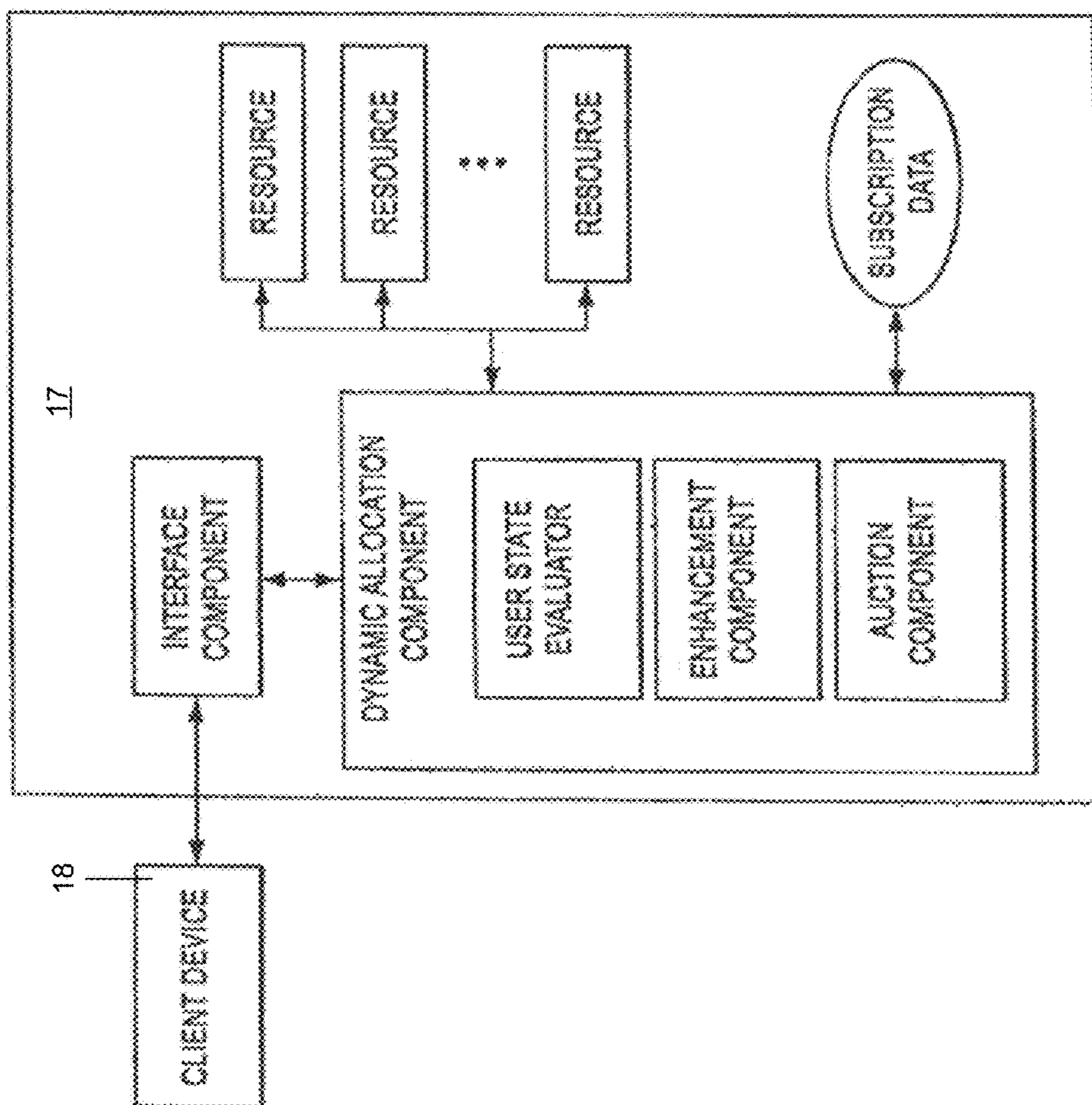


FIG. 10C

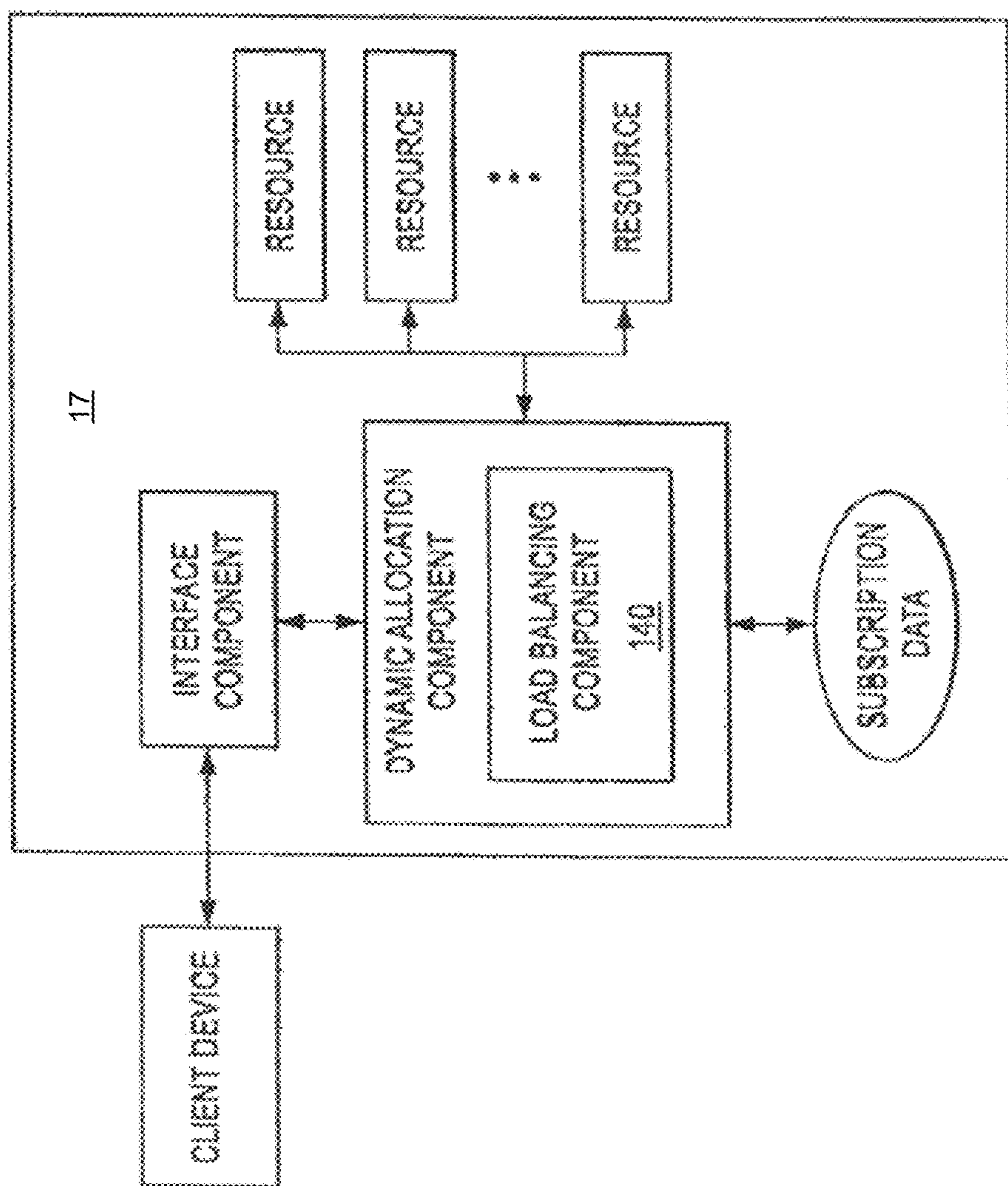


FIG. 10D

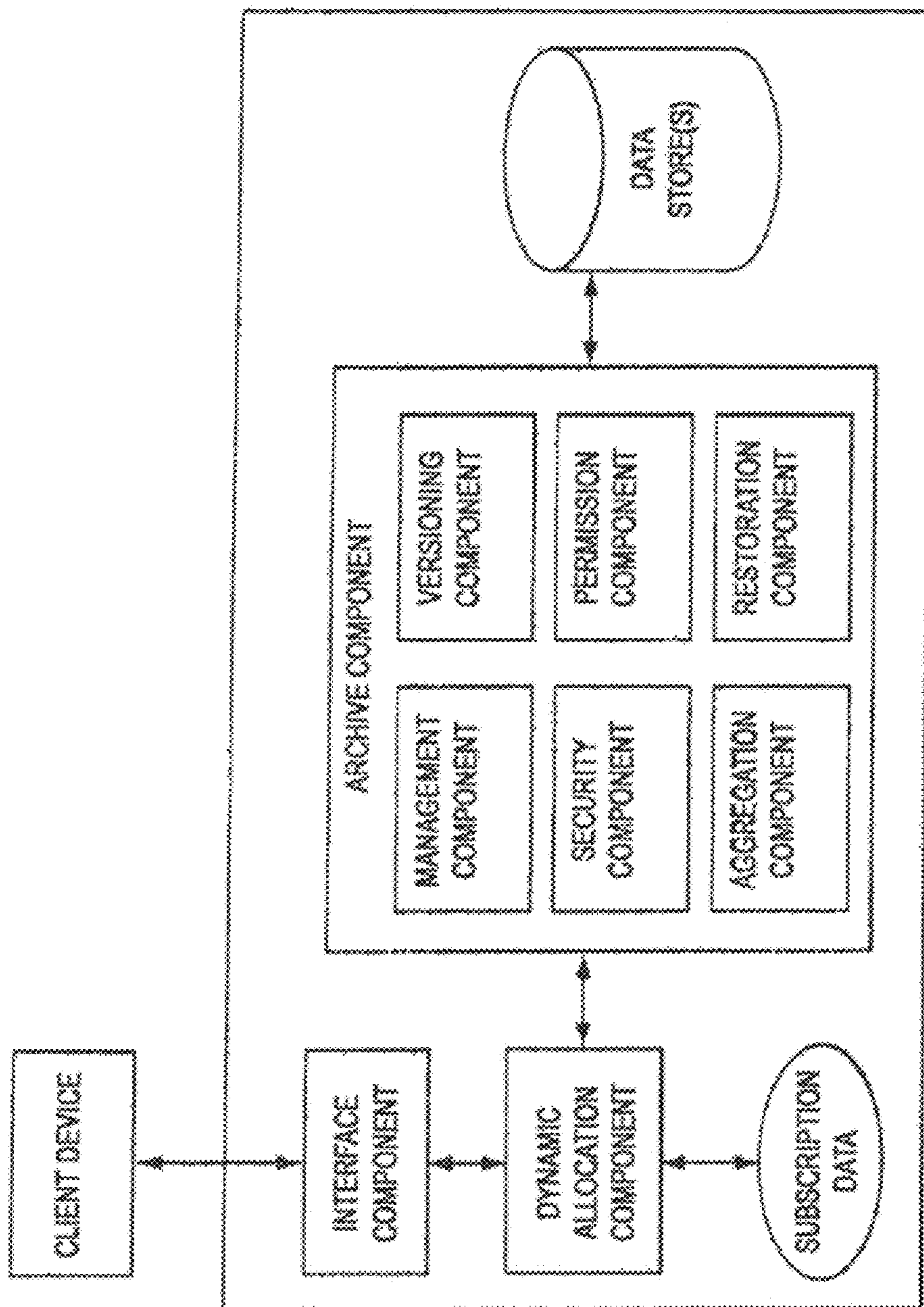


FIG. 10E

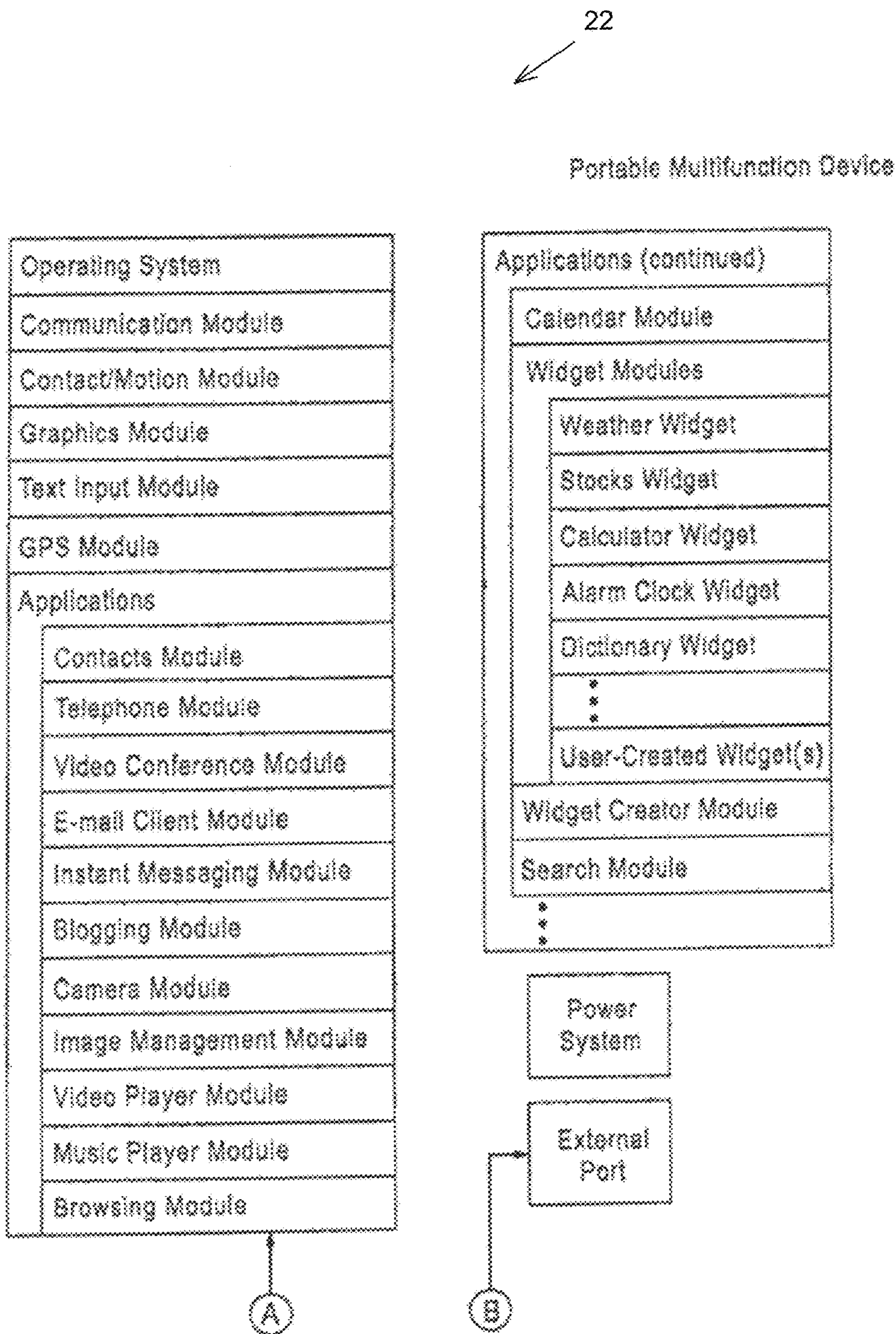


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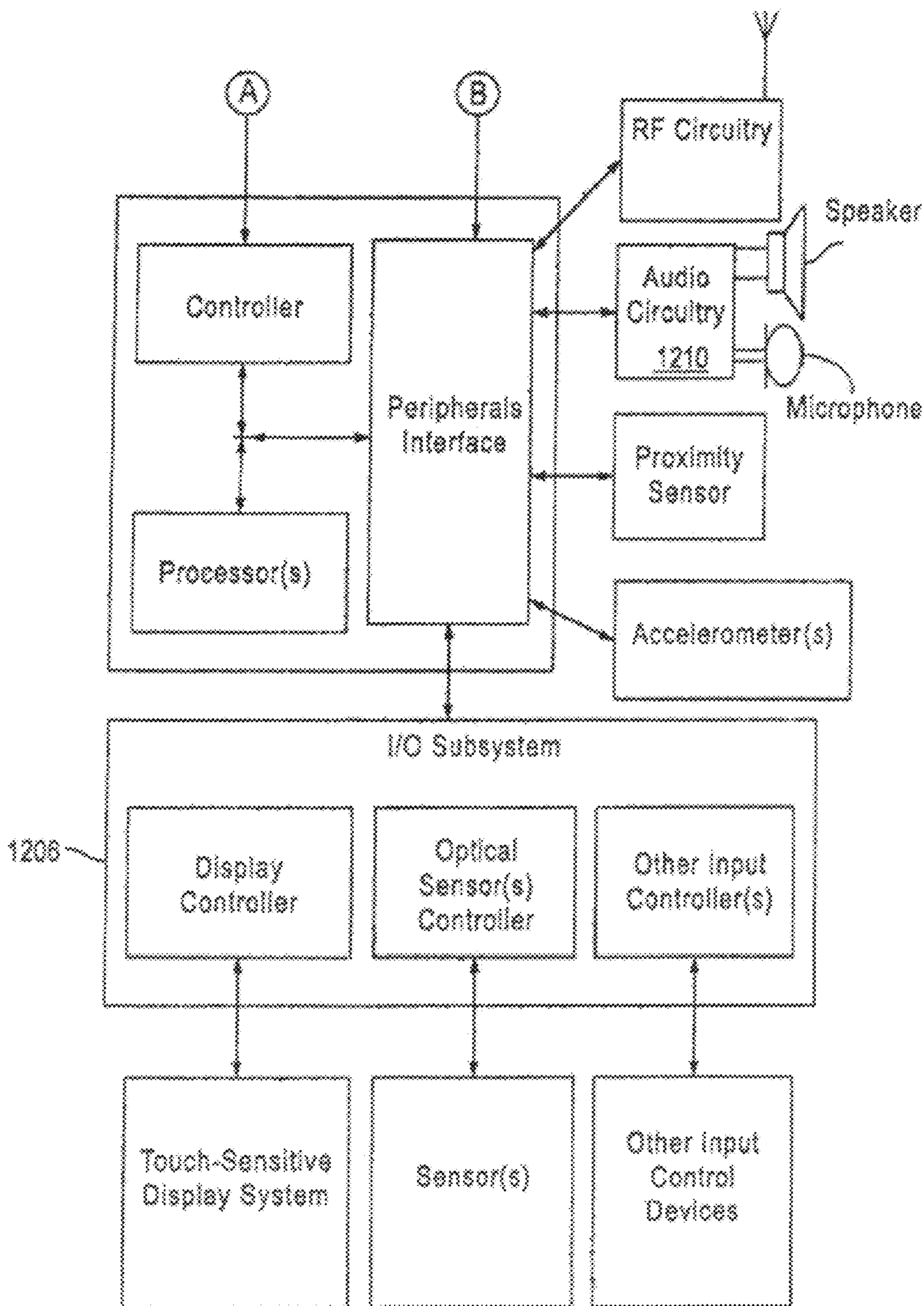


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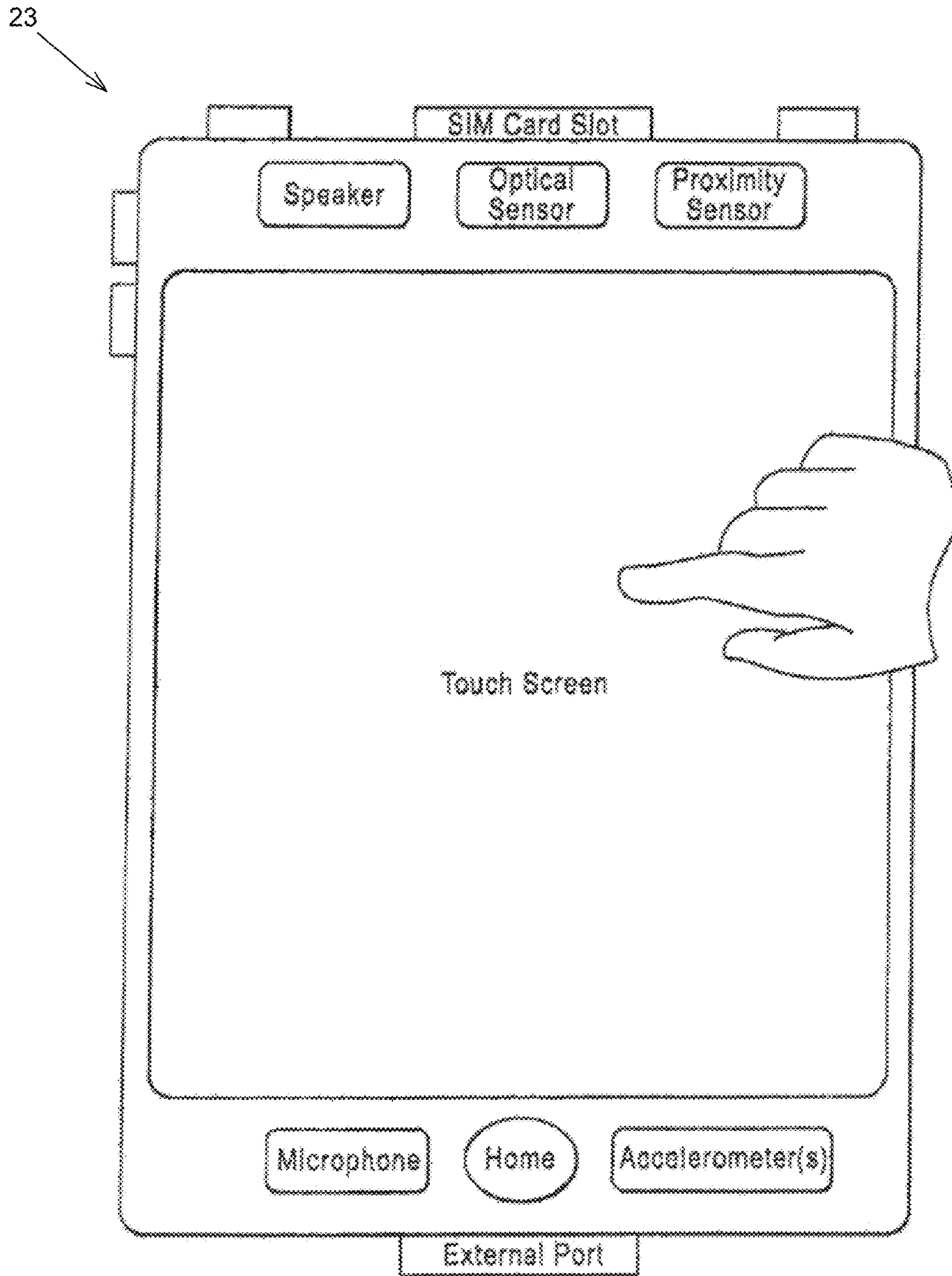


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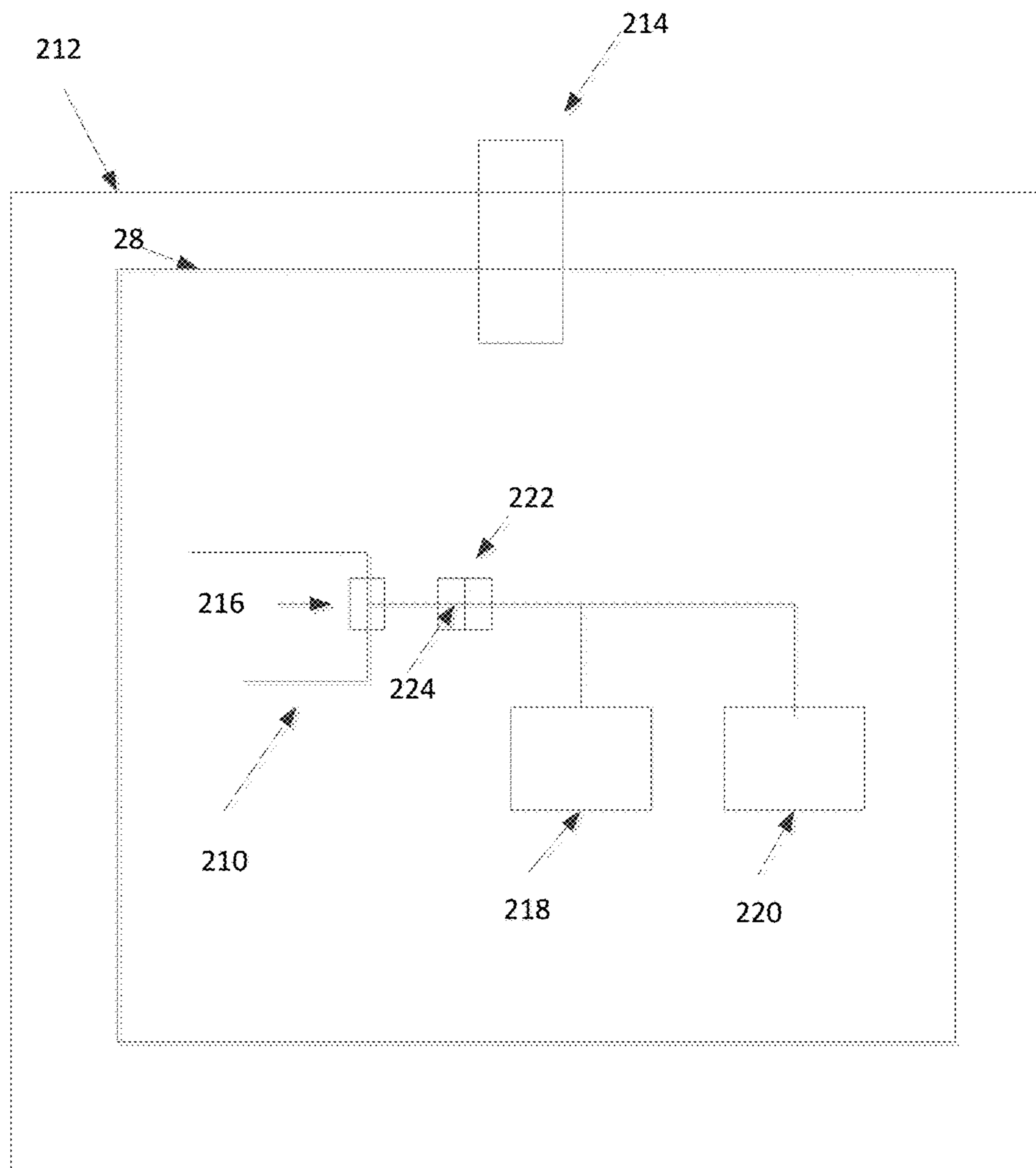


FIG. 14

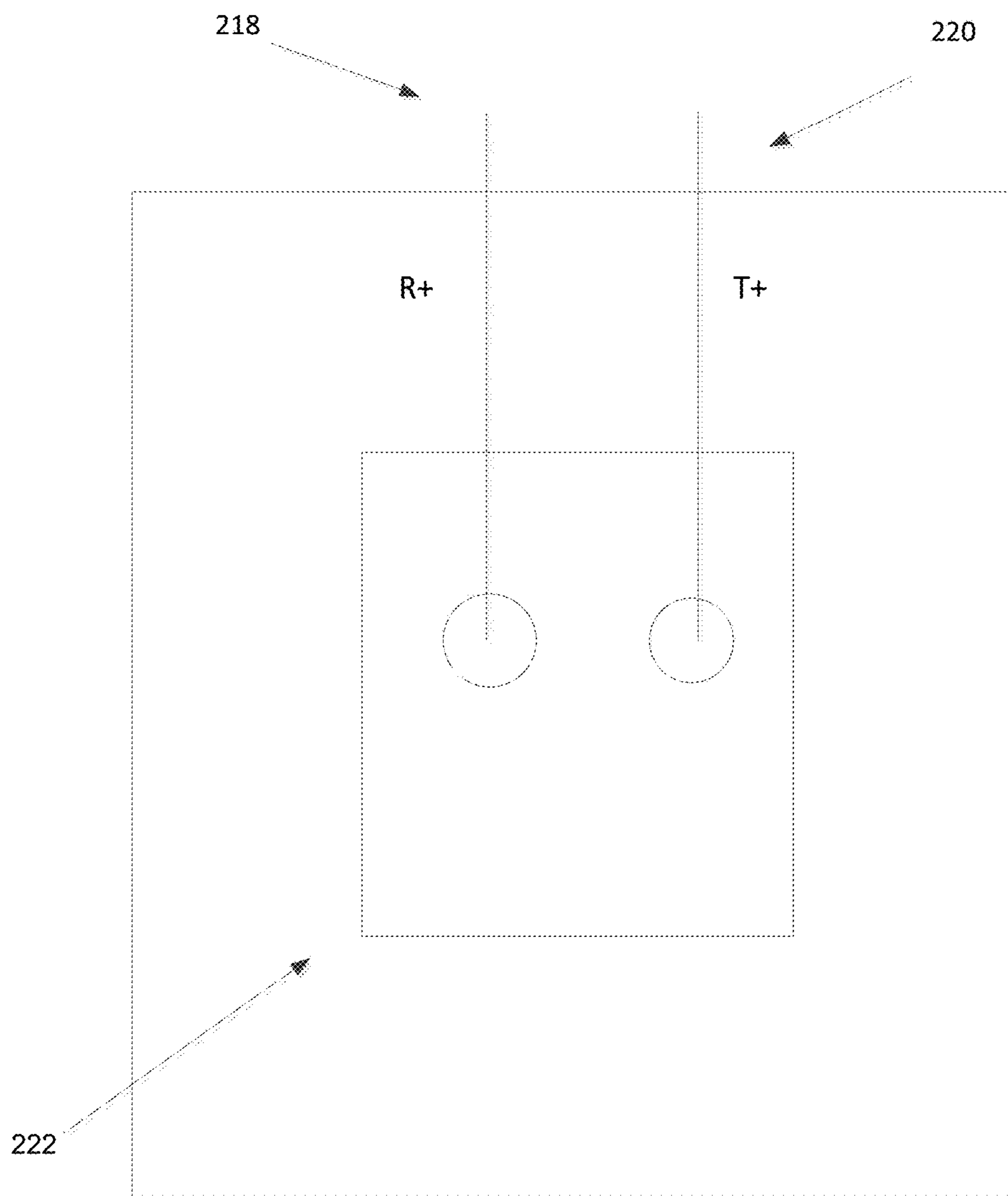


FIG. 15

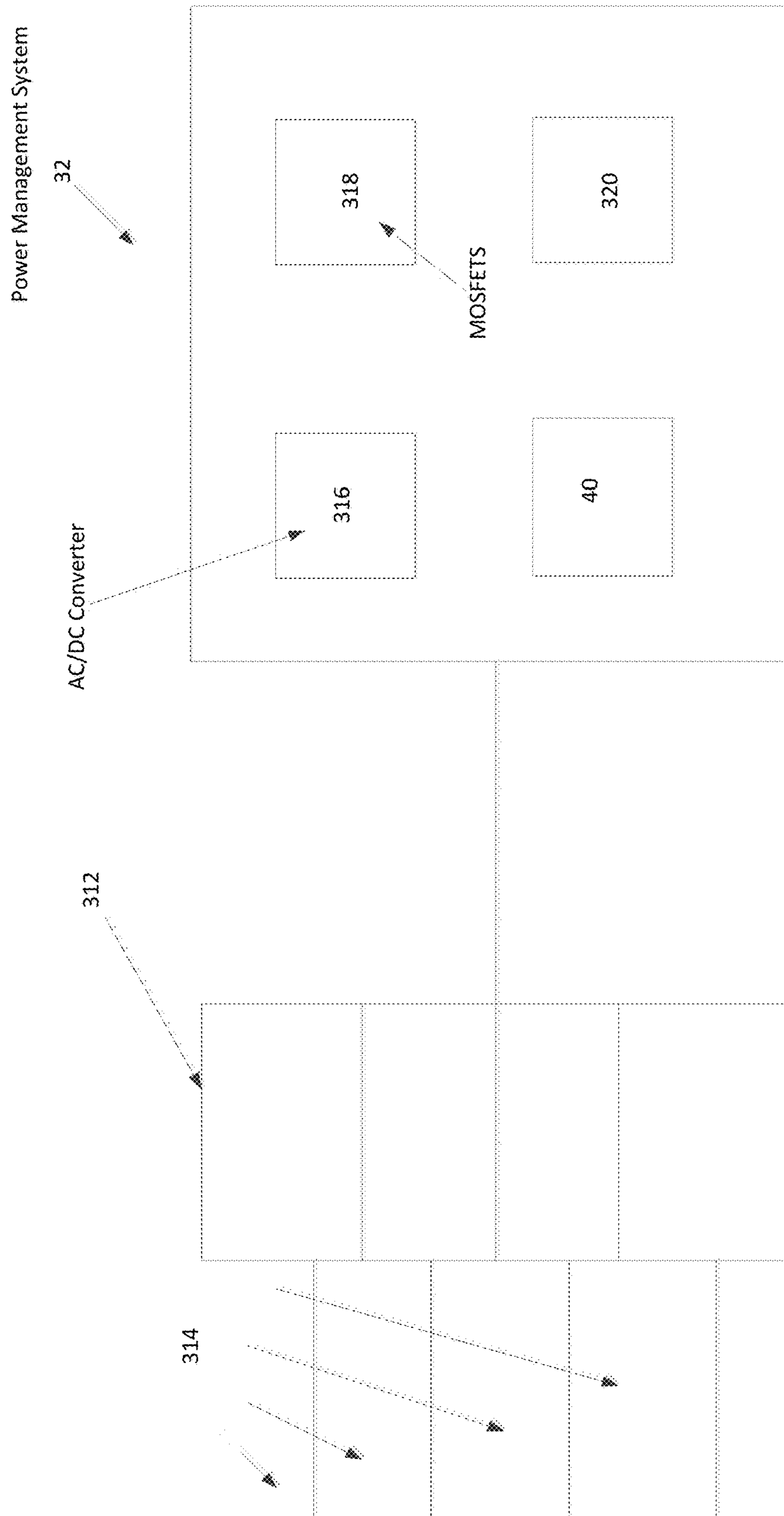


FIG. 16

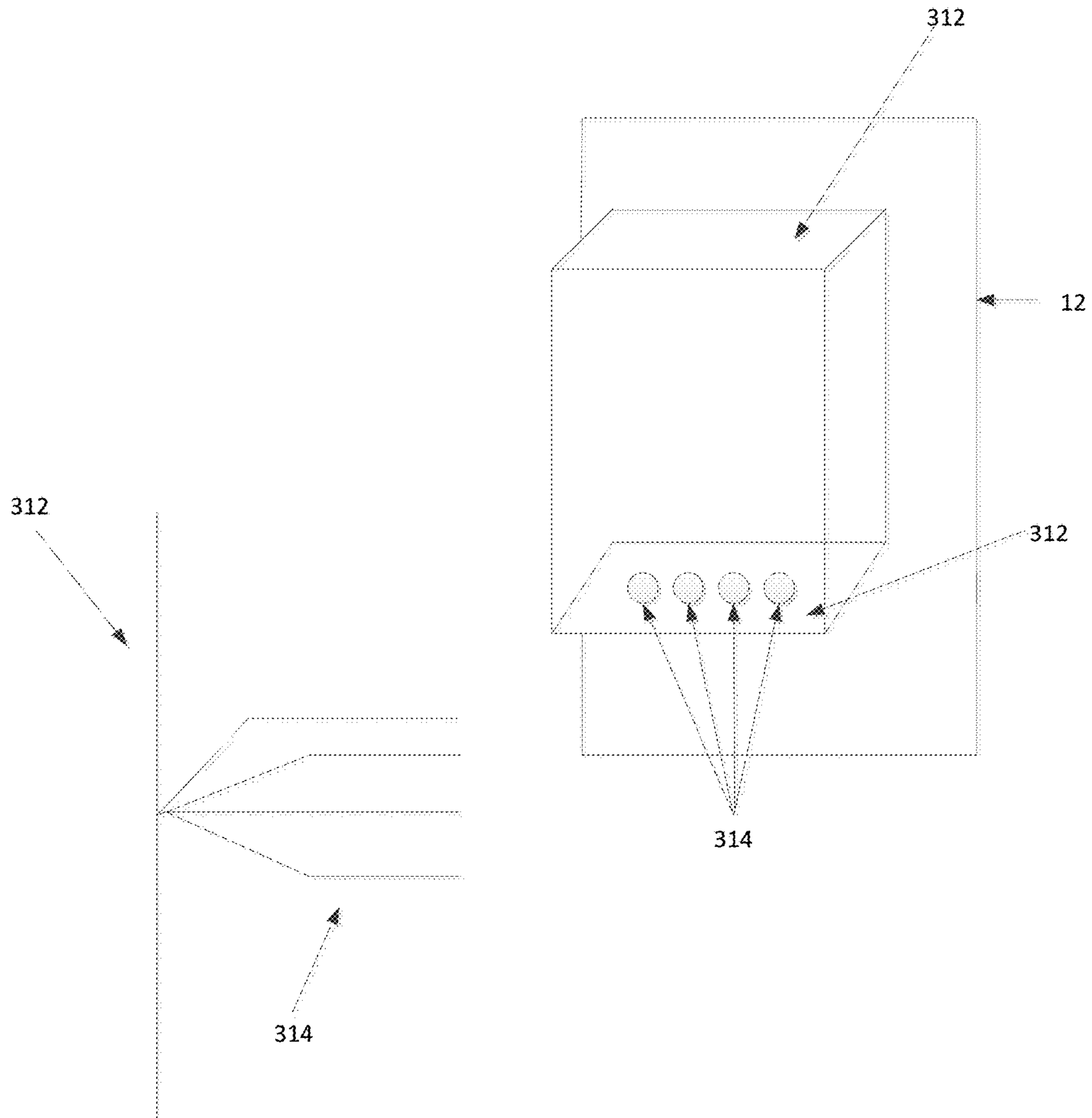


FIG.17

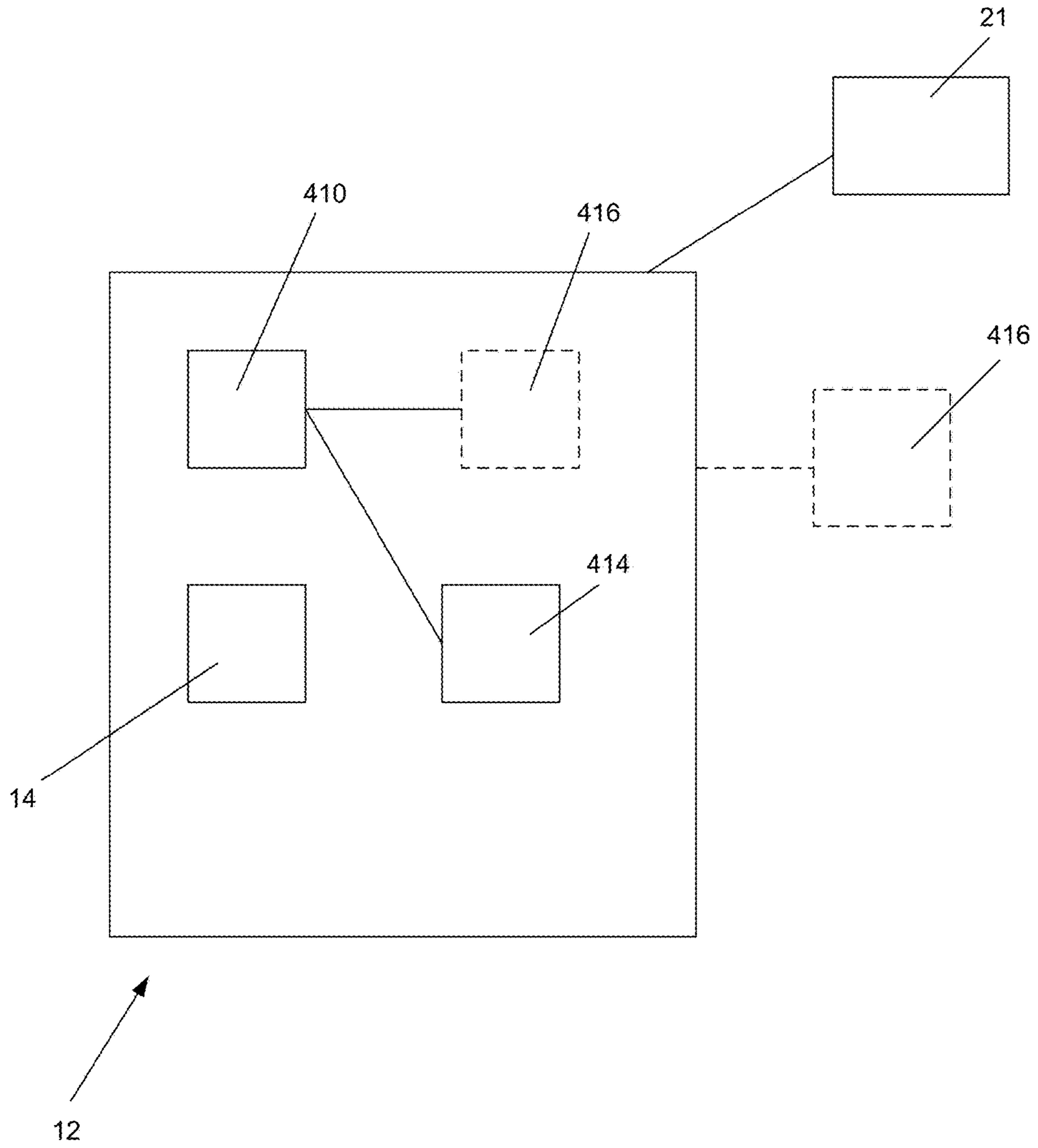


FIG. 18

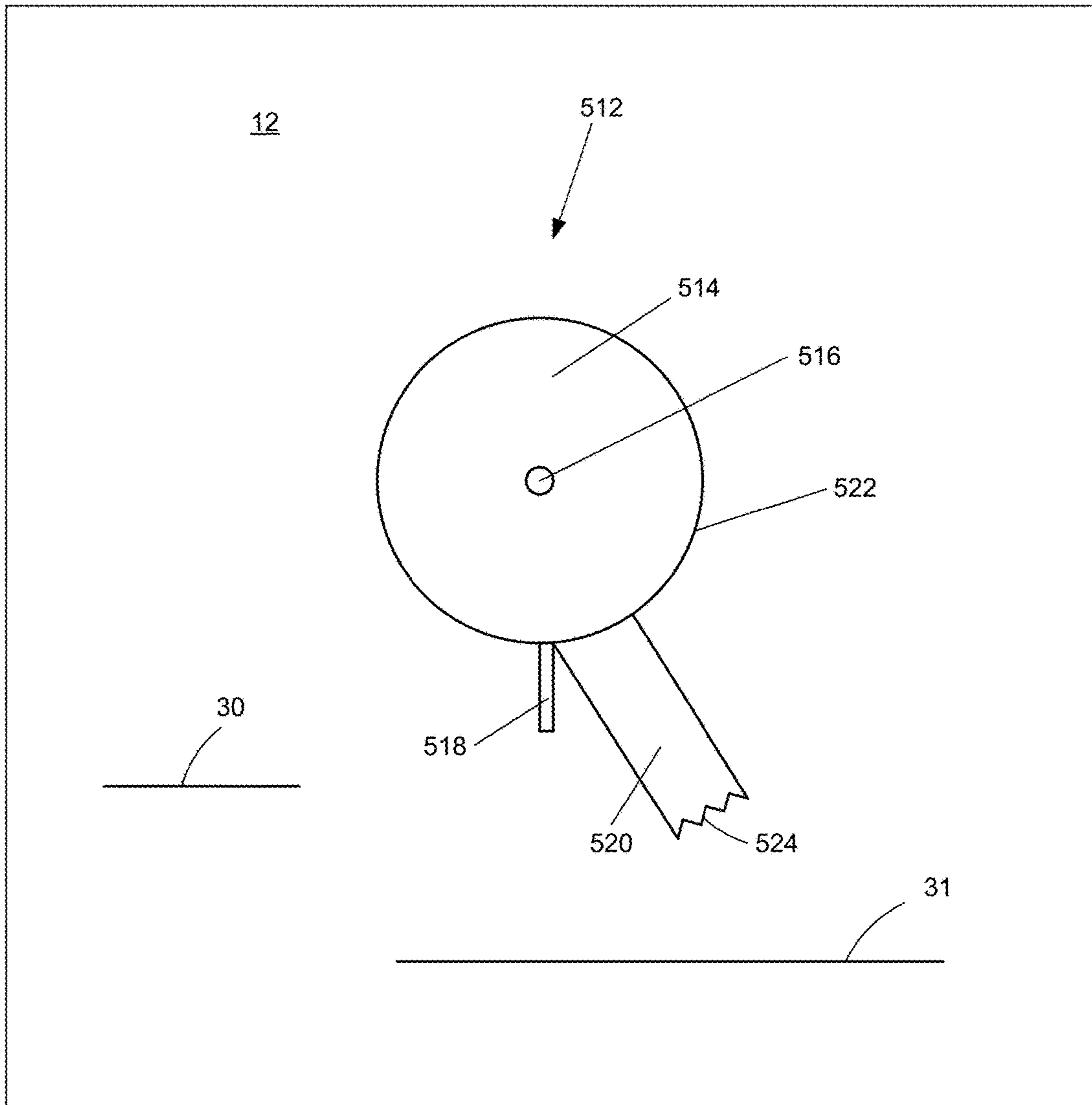


FIG. 19

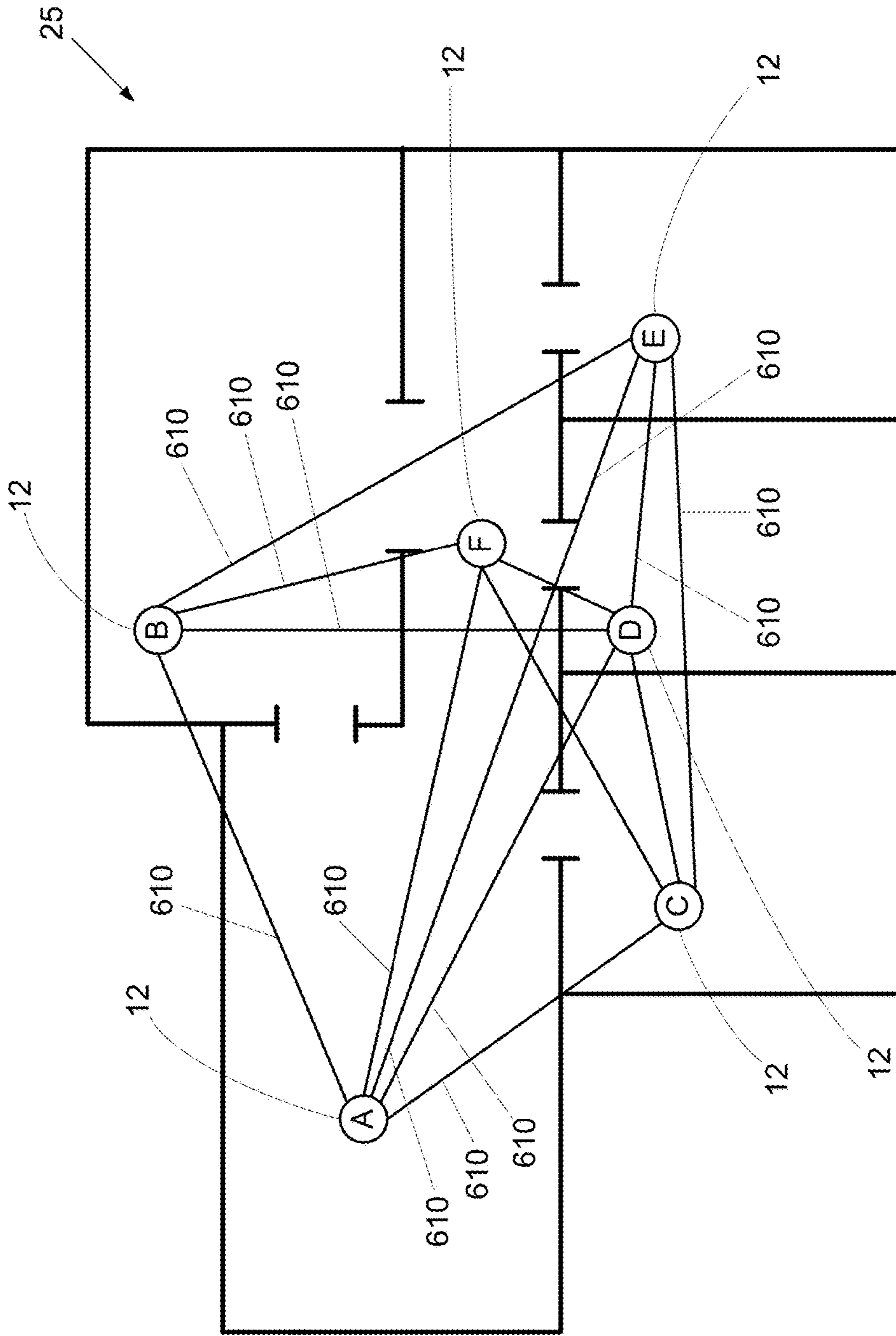


FIG. 20

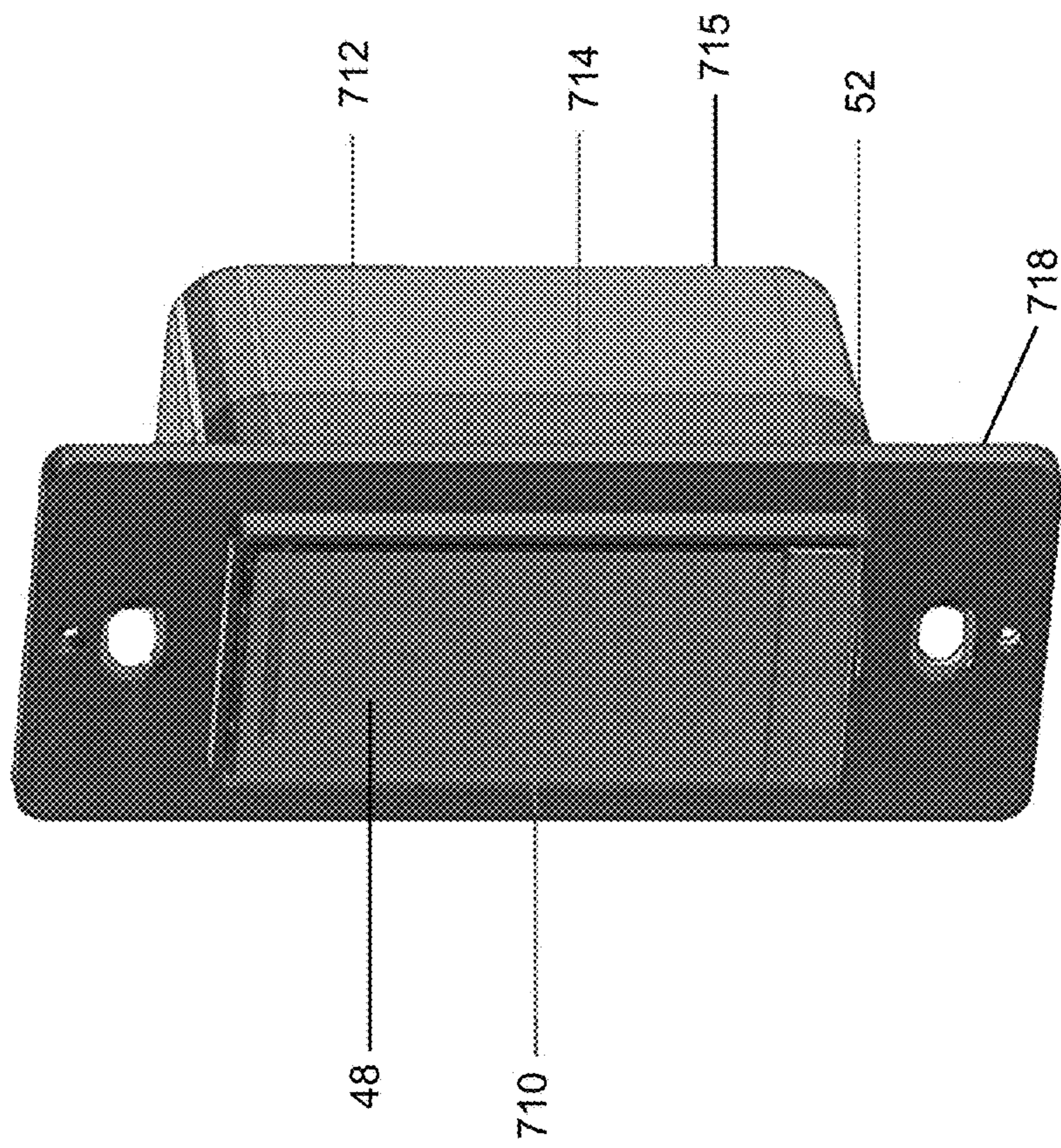


FIG. 21A

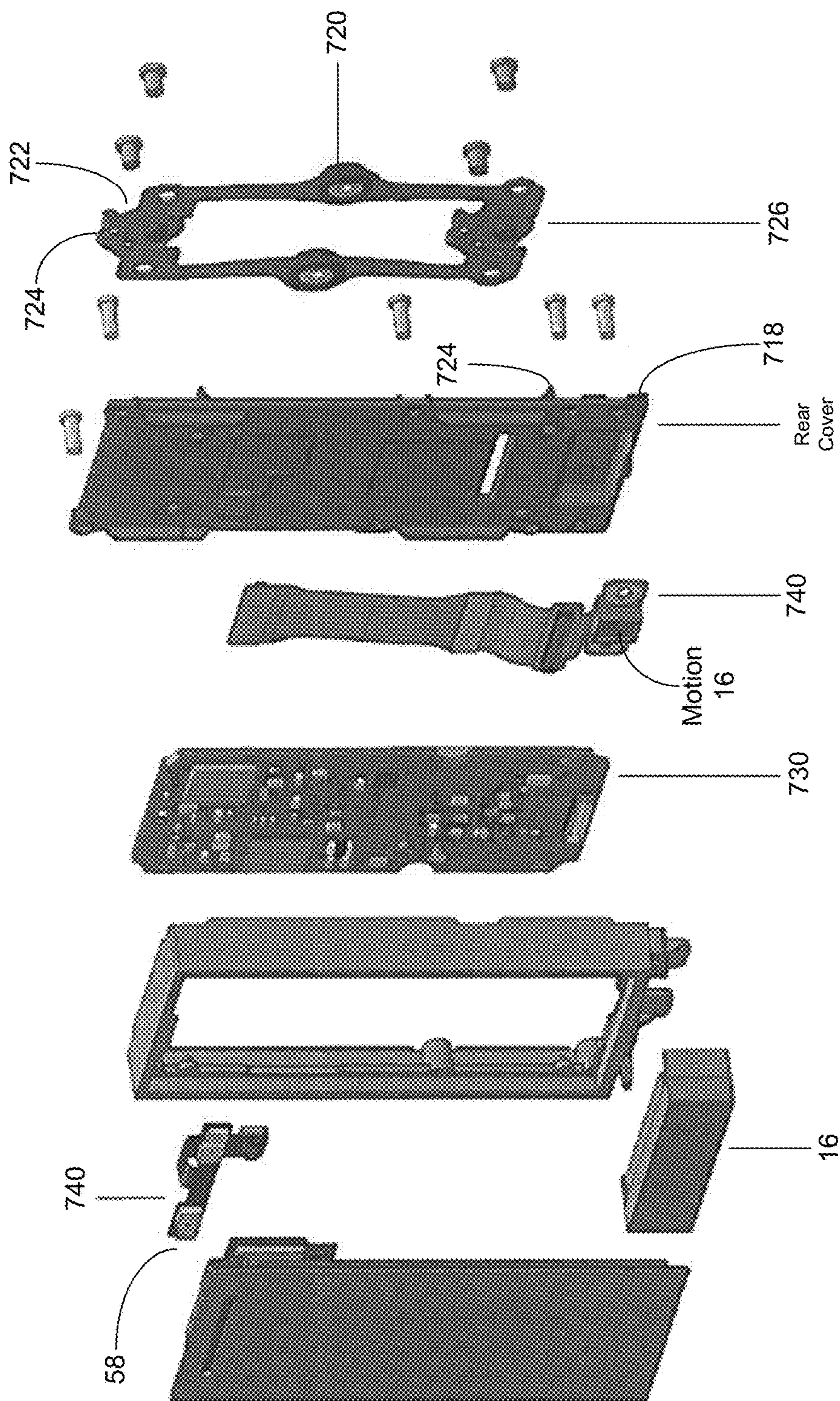


FIG. 21B

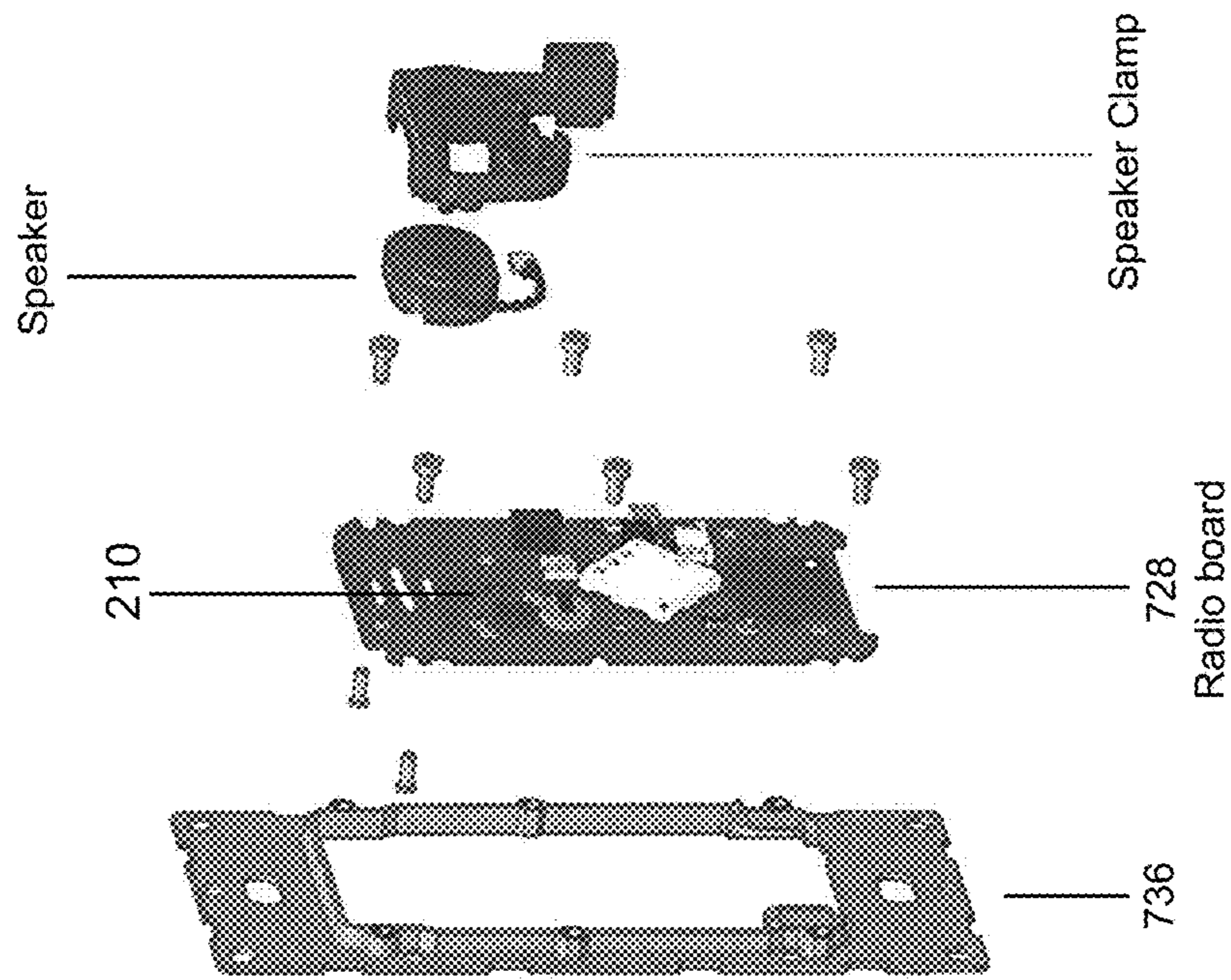


FIG. 21C

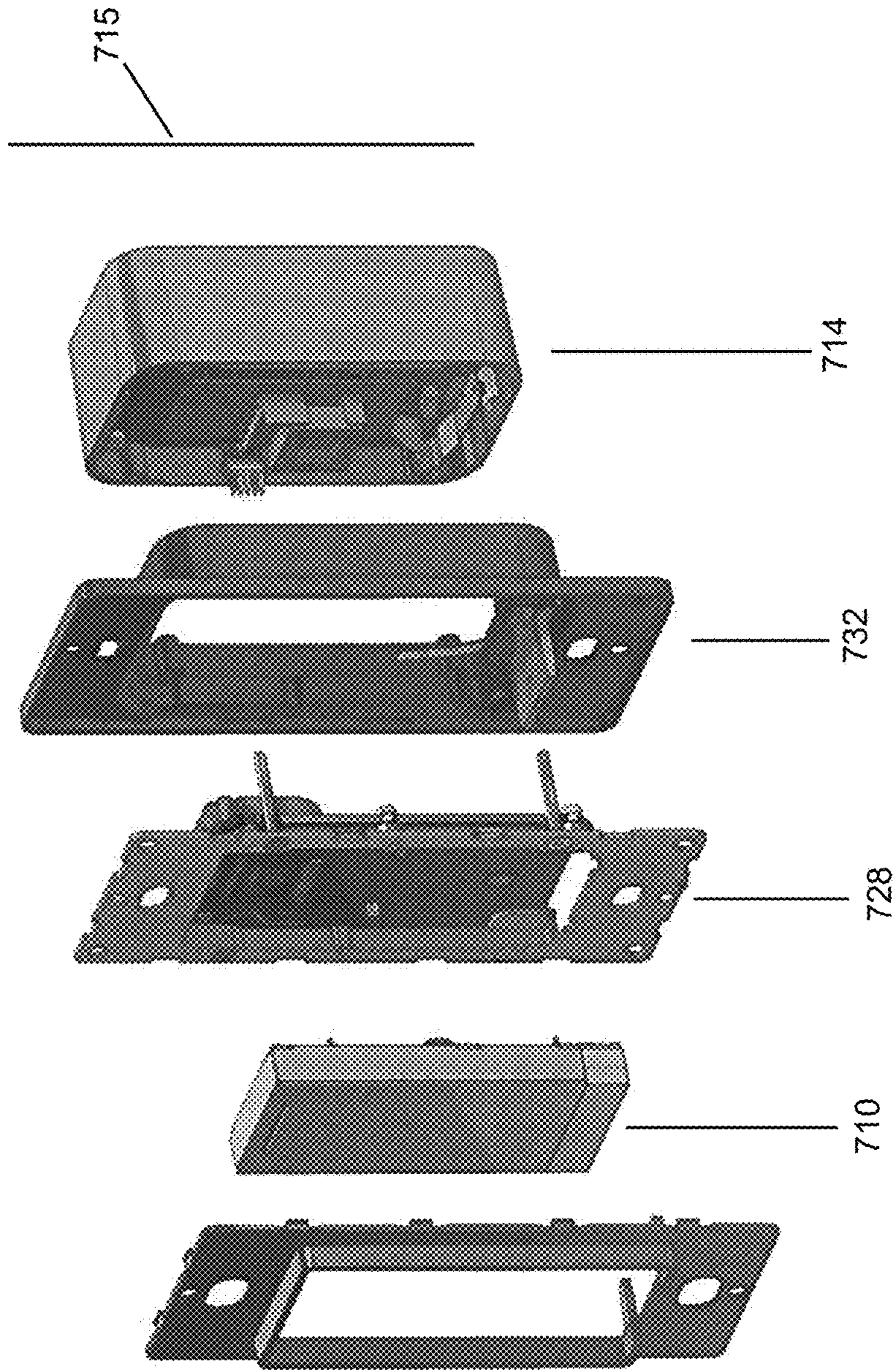


FIG. 21D

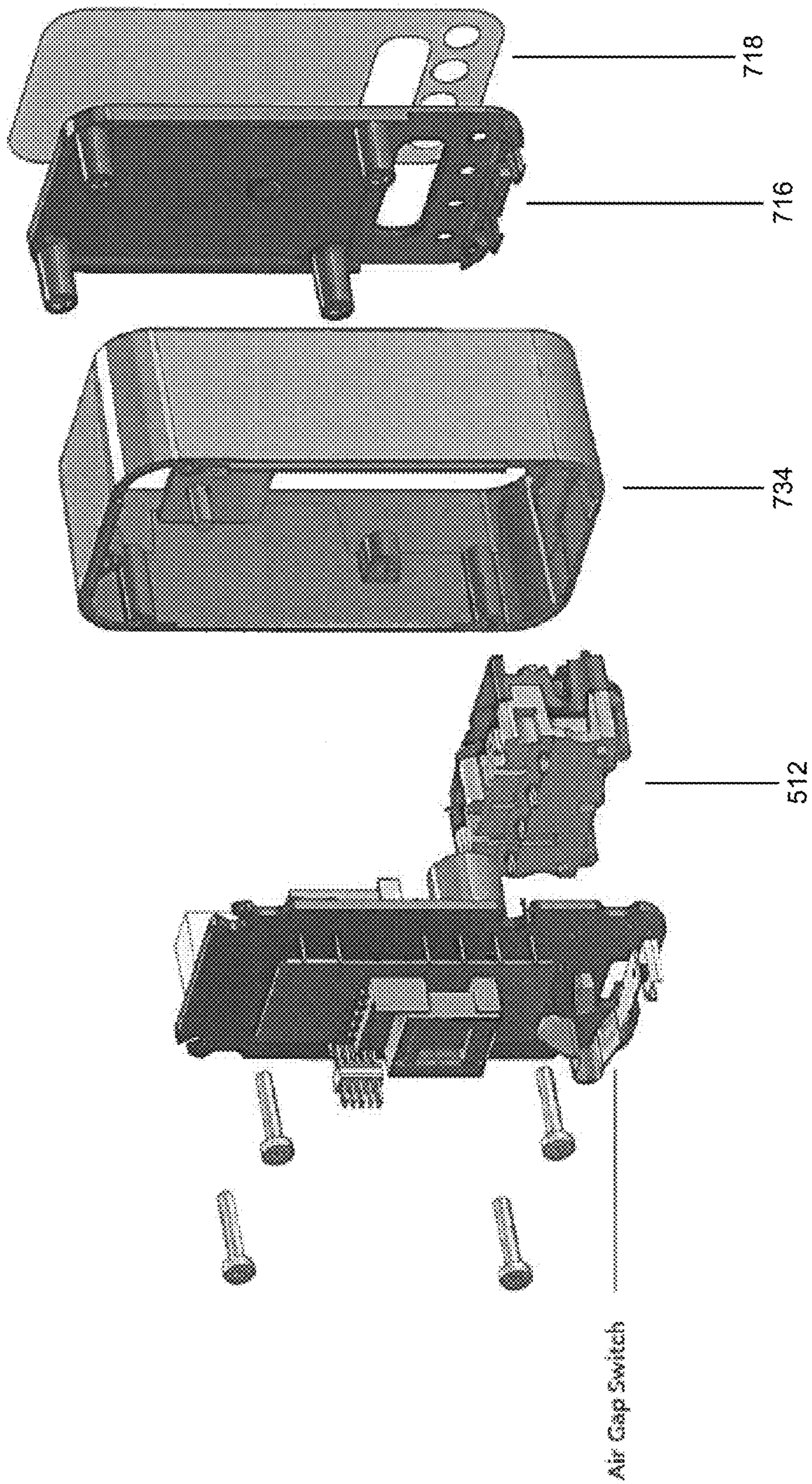


FIG. 21E

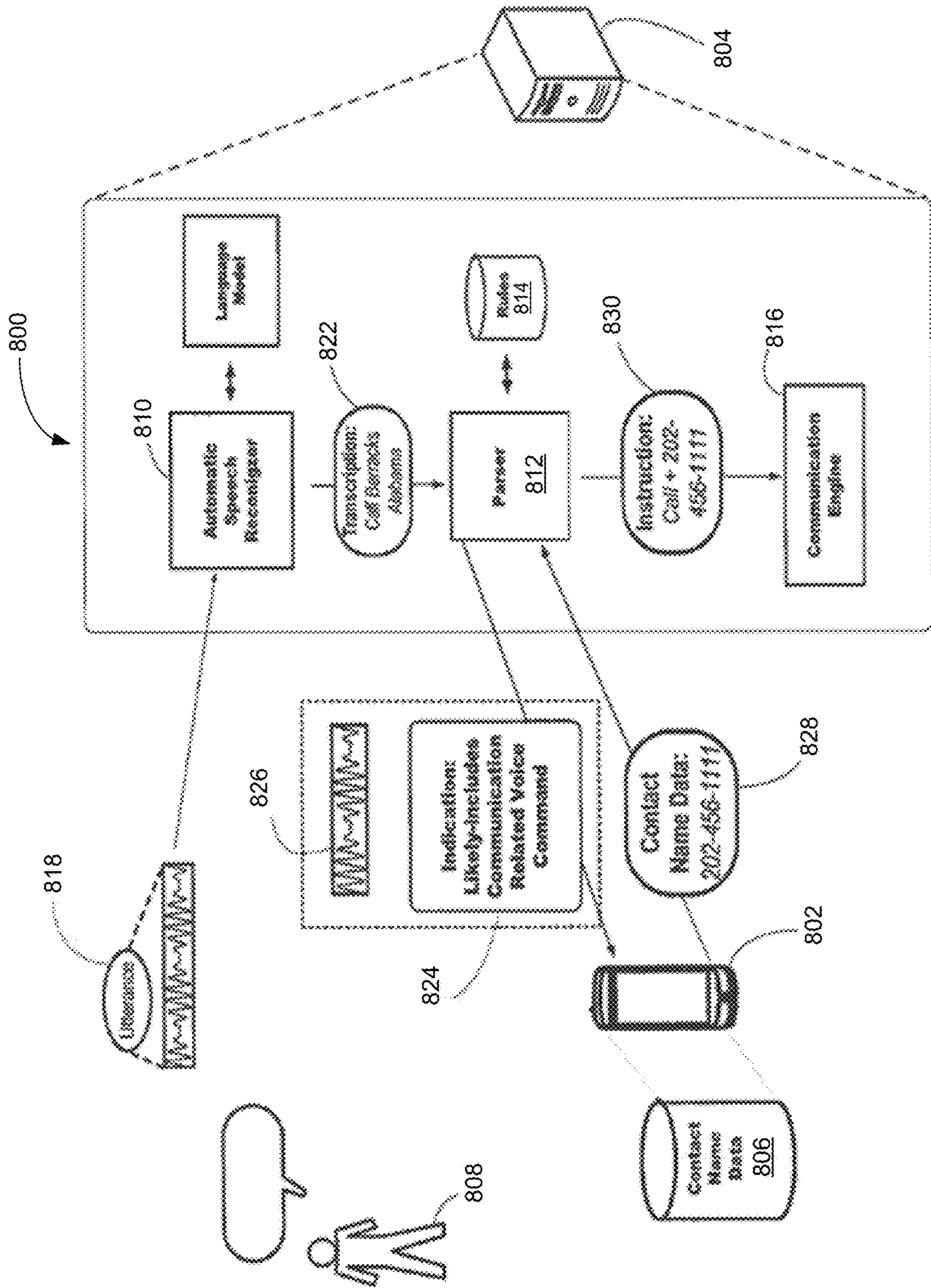


FIG. 22

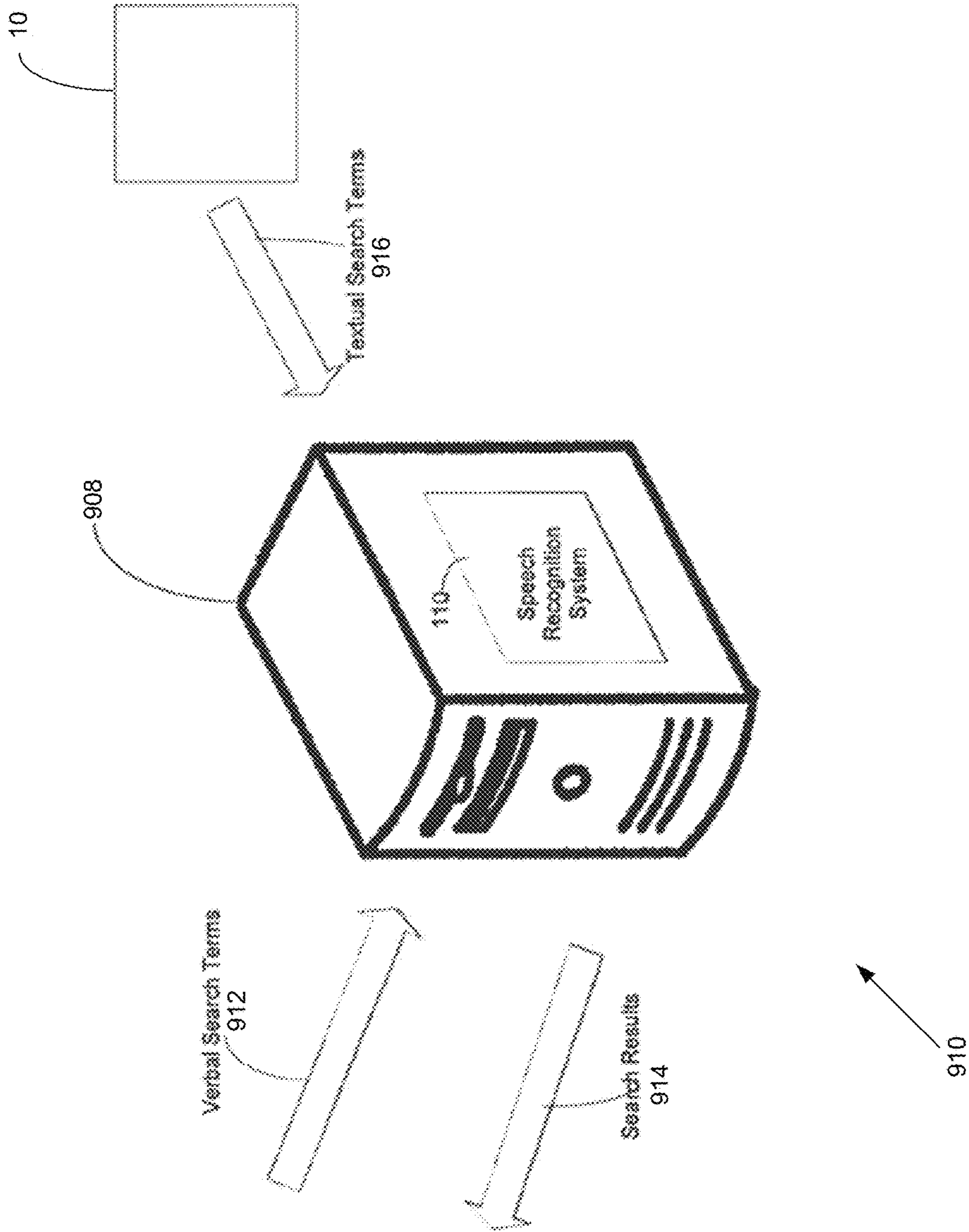


FIG. 23

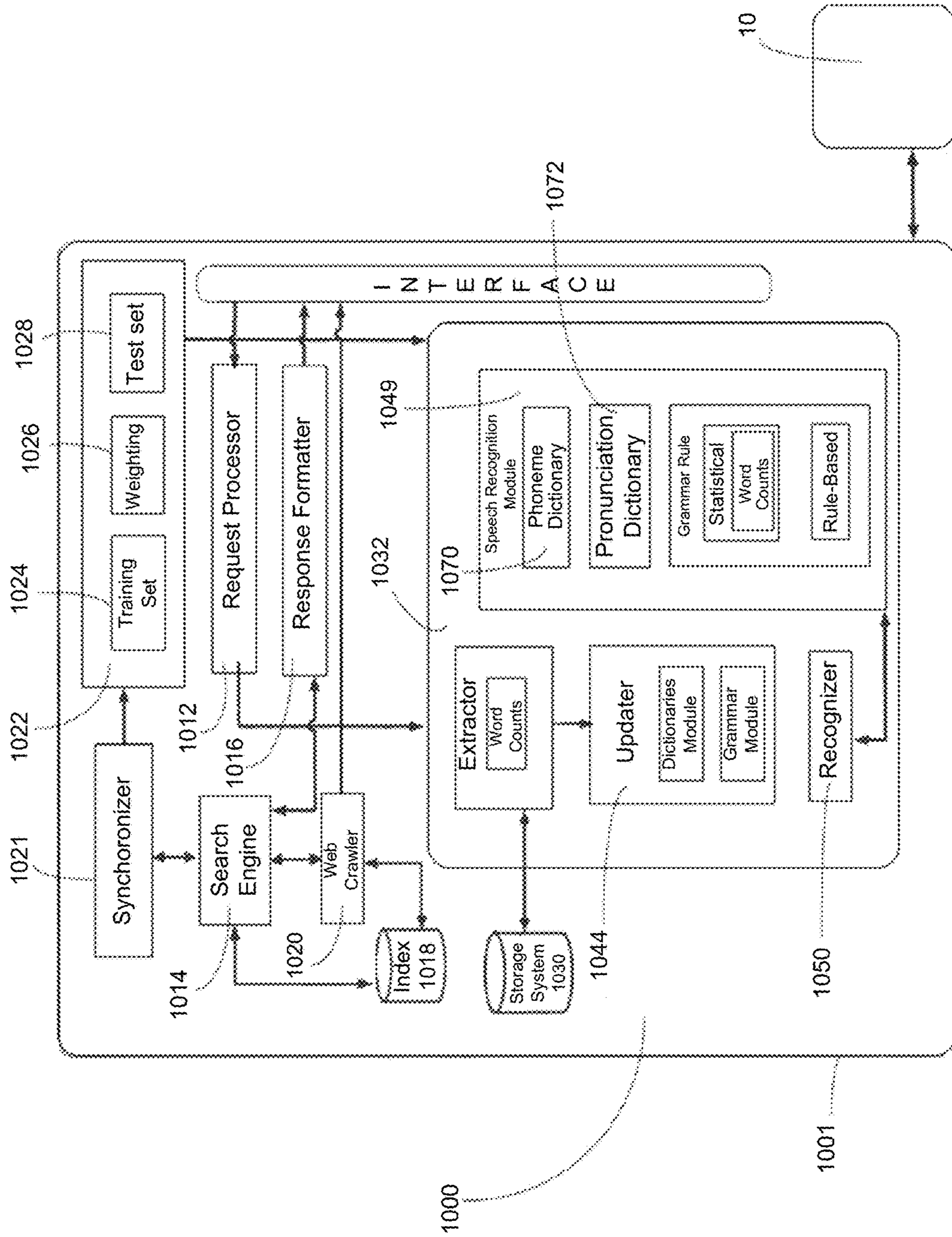


FIG. 24

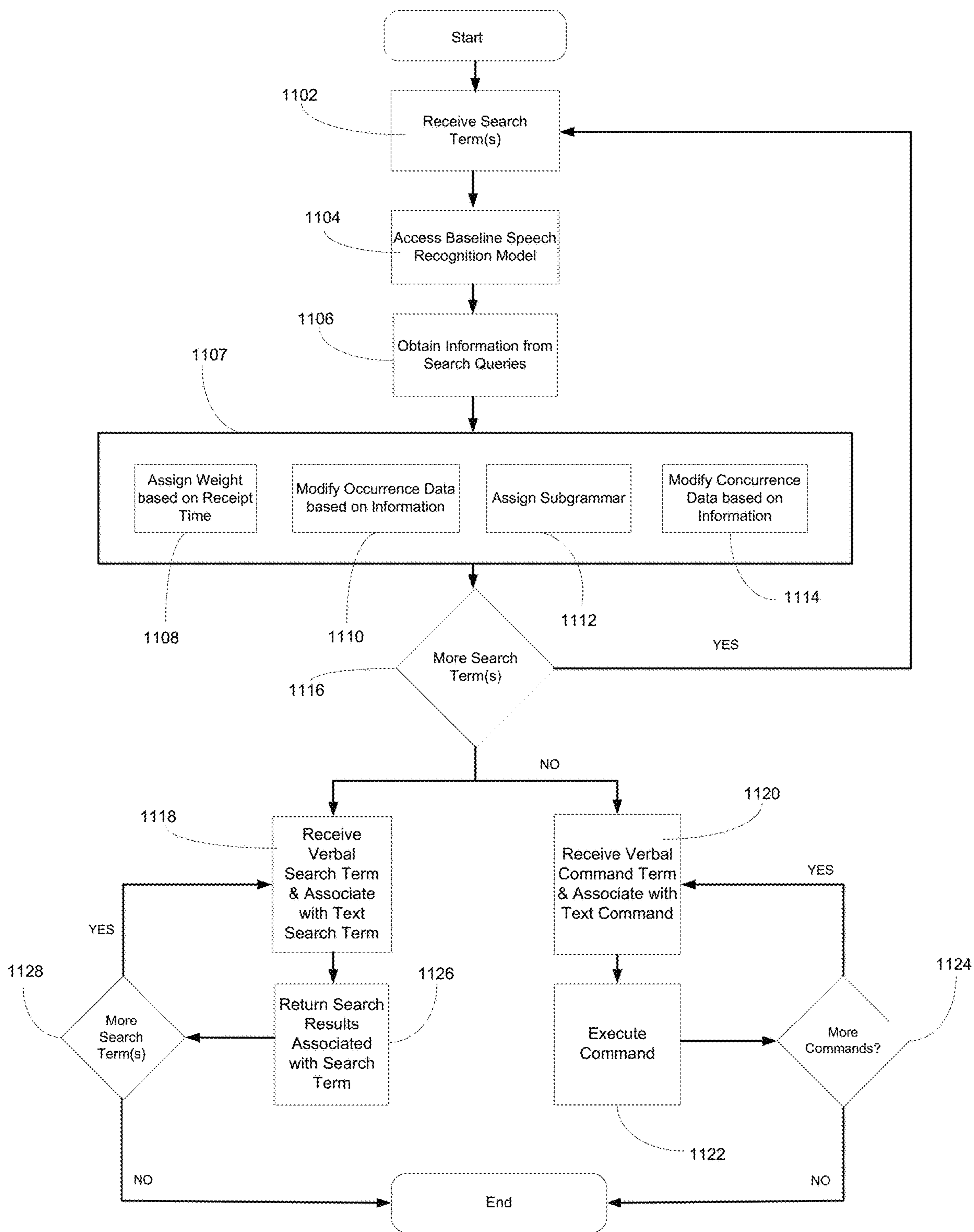


FIG. 25

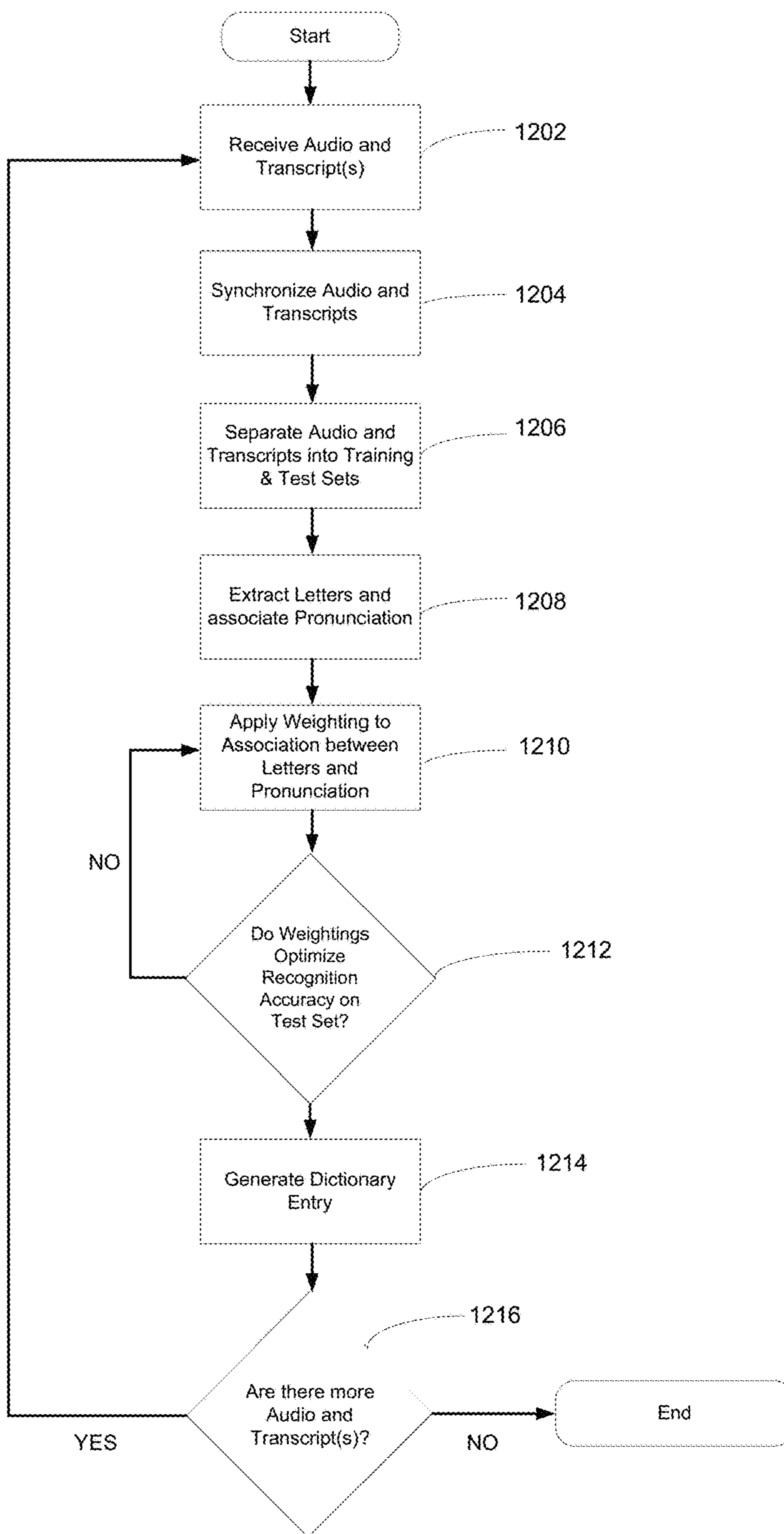


FIG. 26

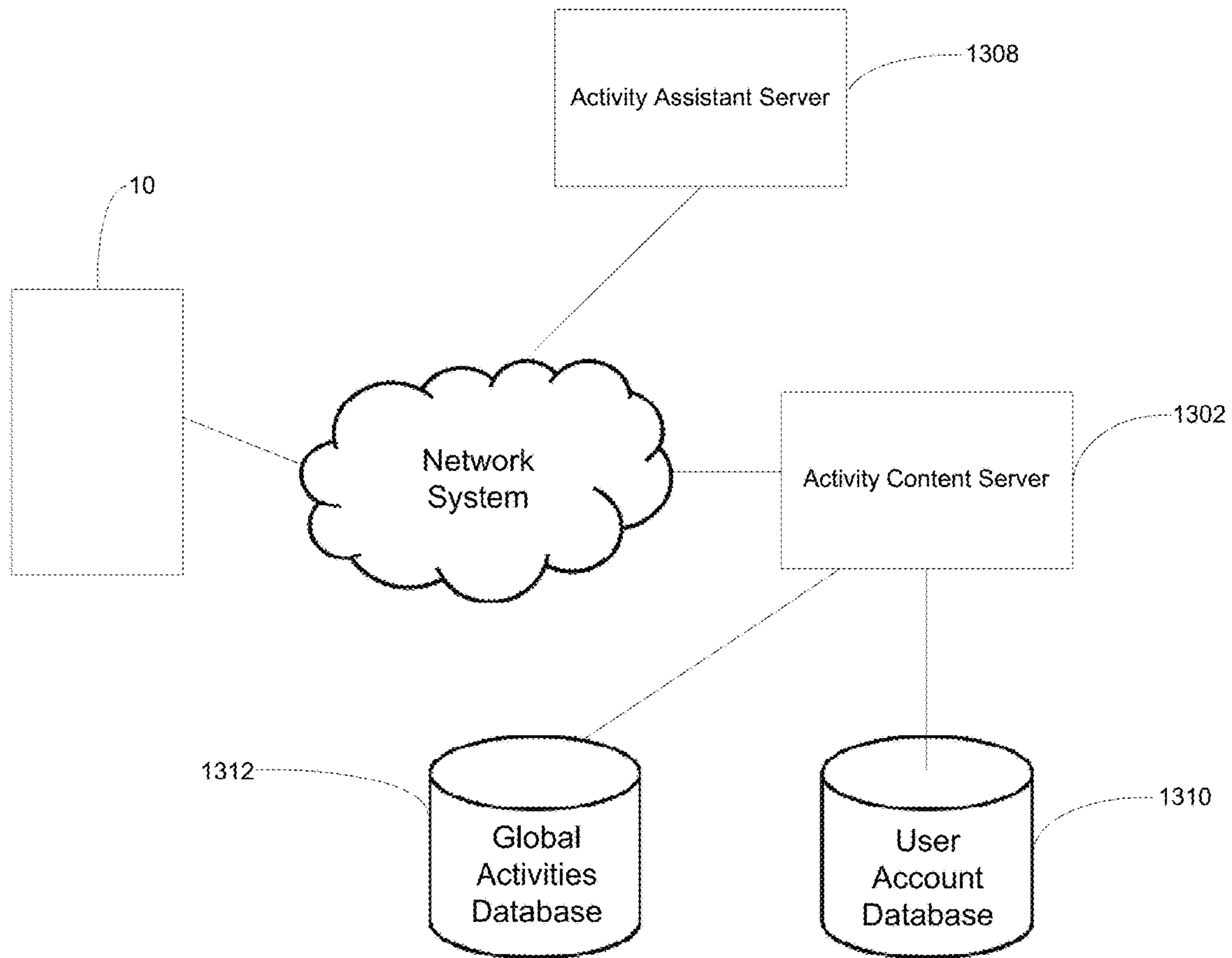


FIG. 27

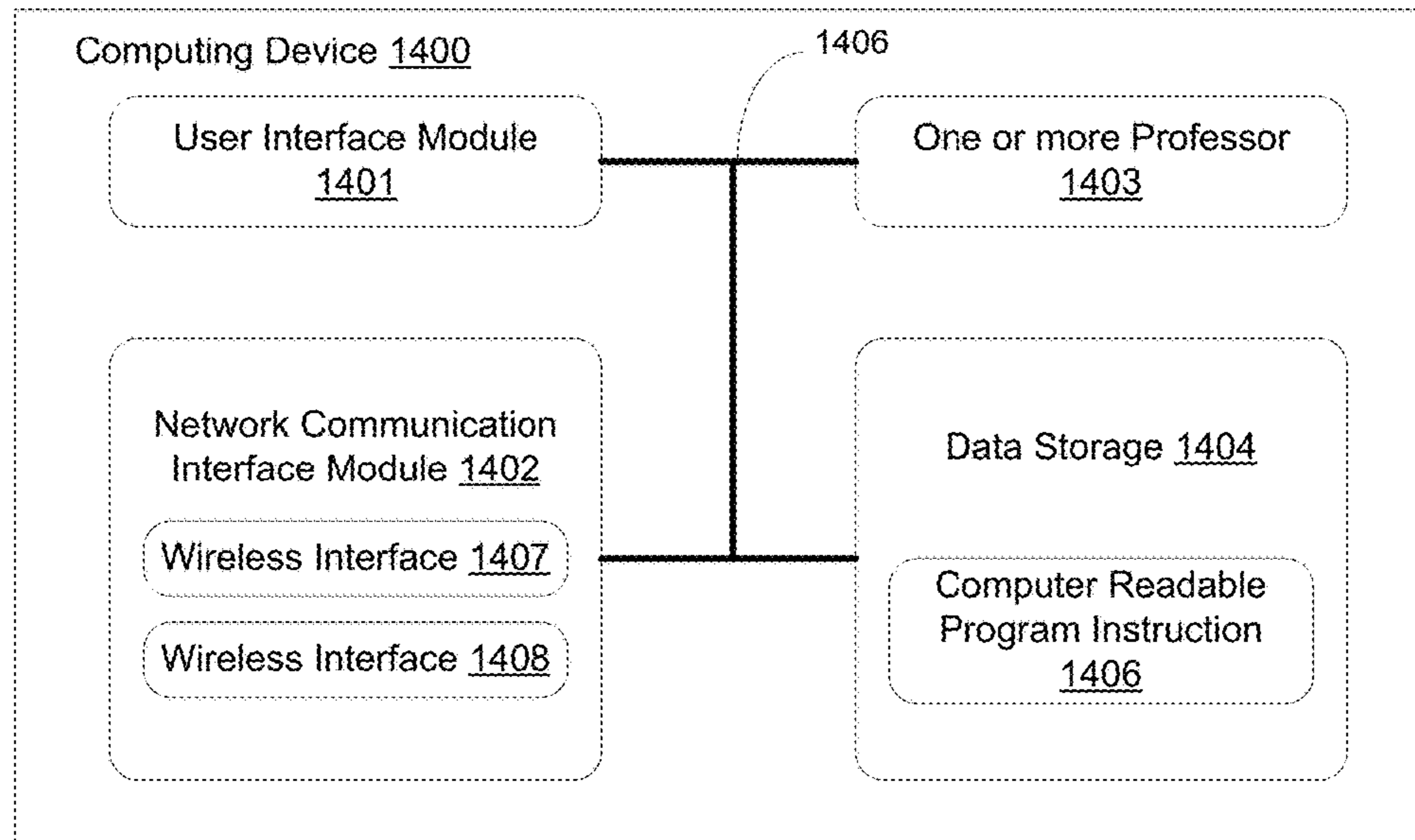


FIG. 28A

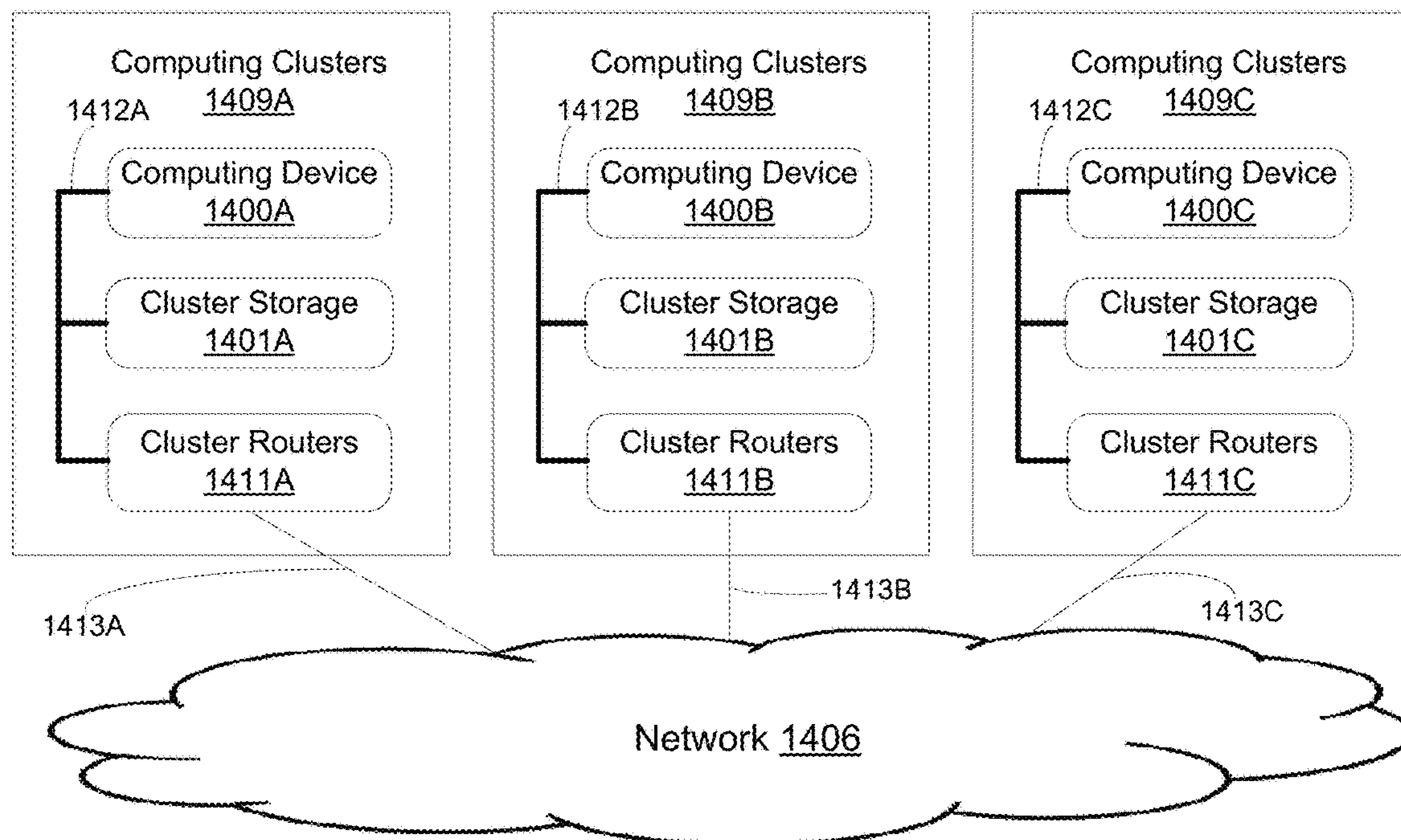


FIG. 28B

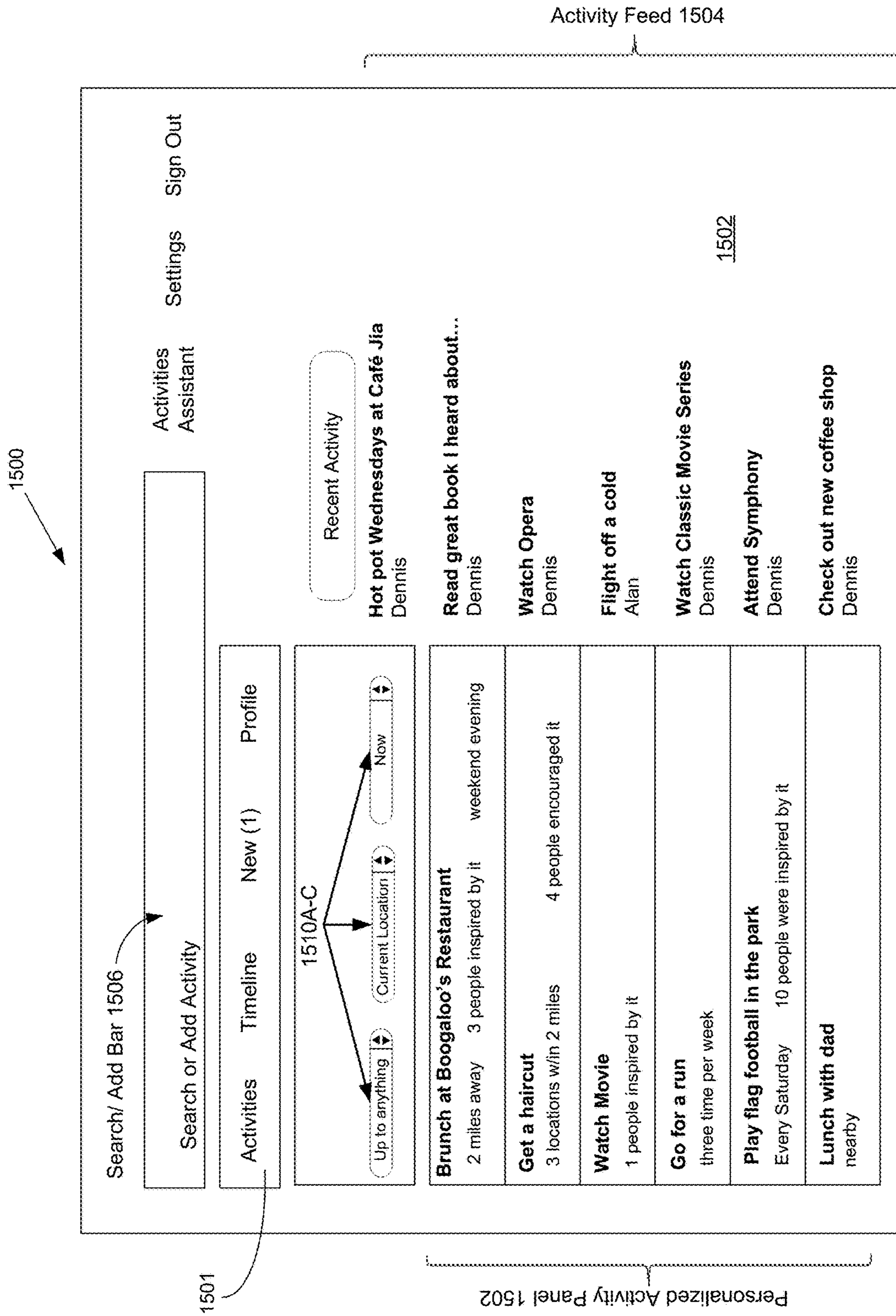


FIG. 29A

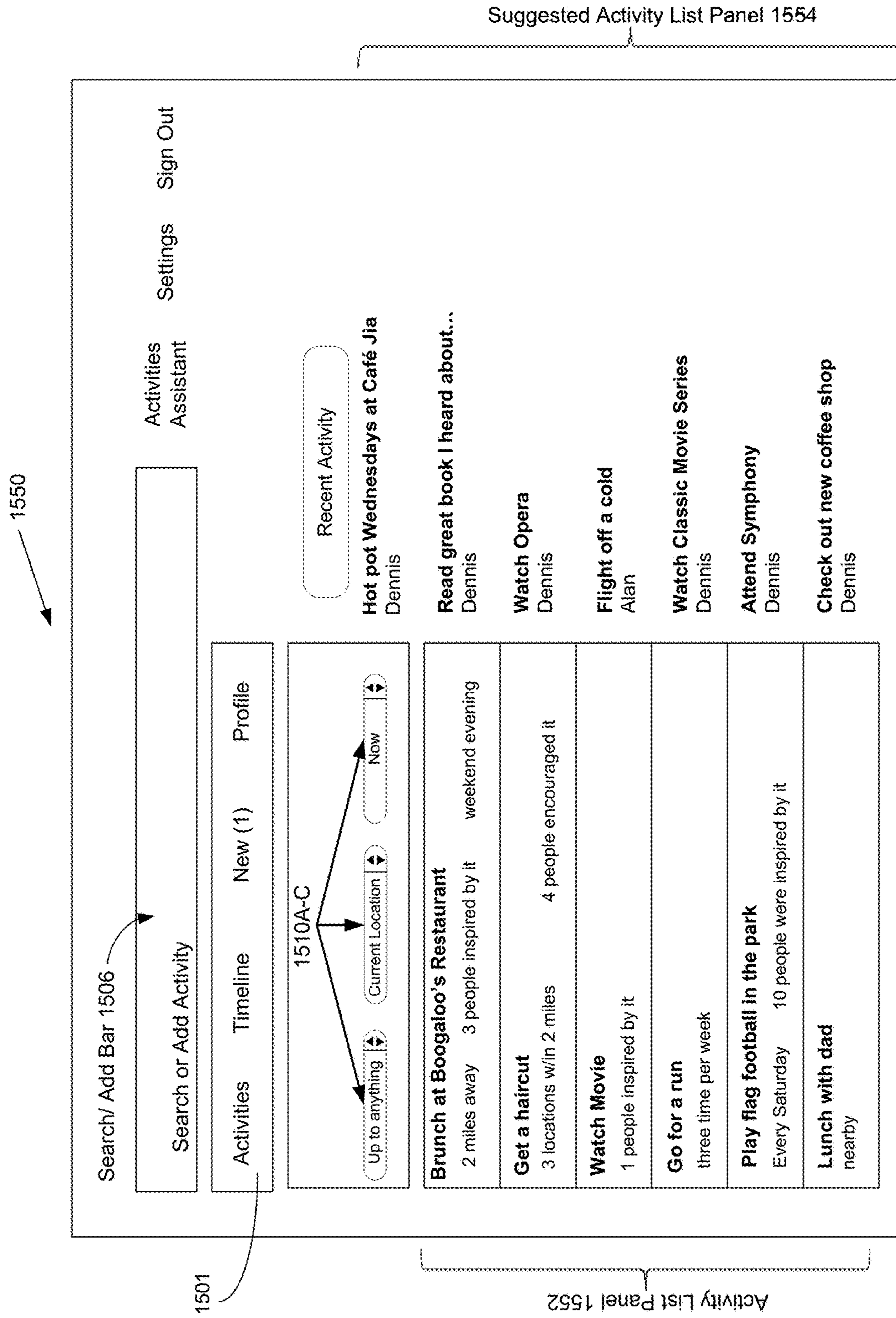


FIG. 29B

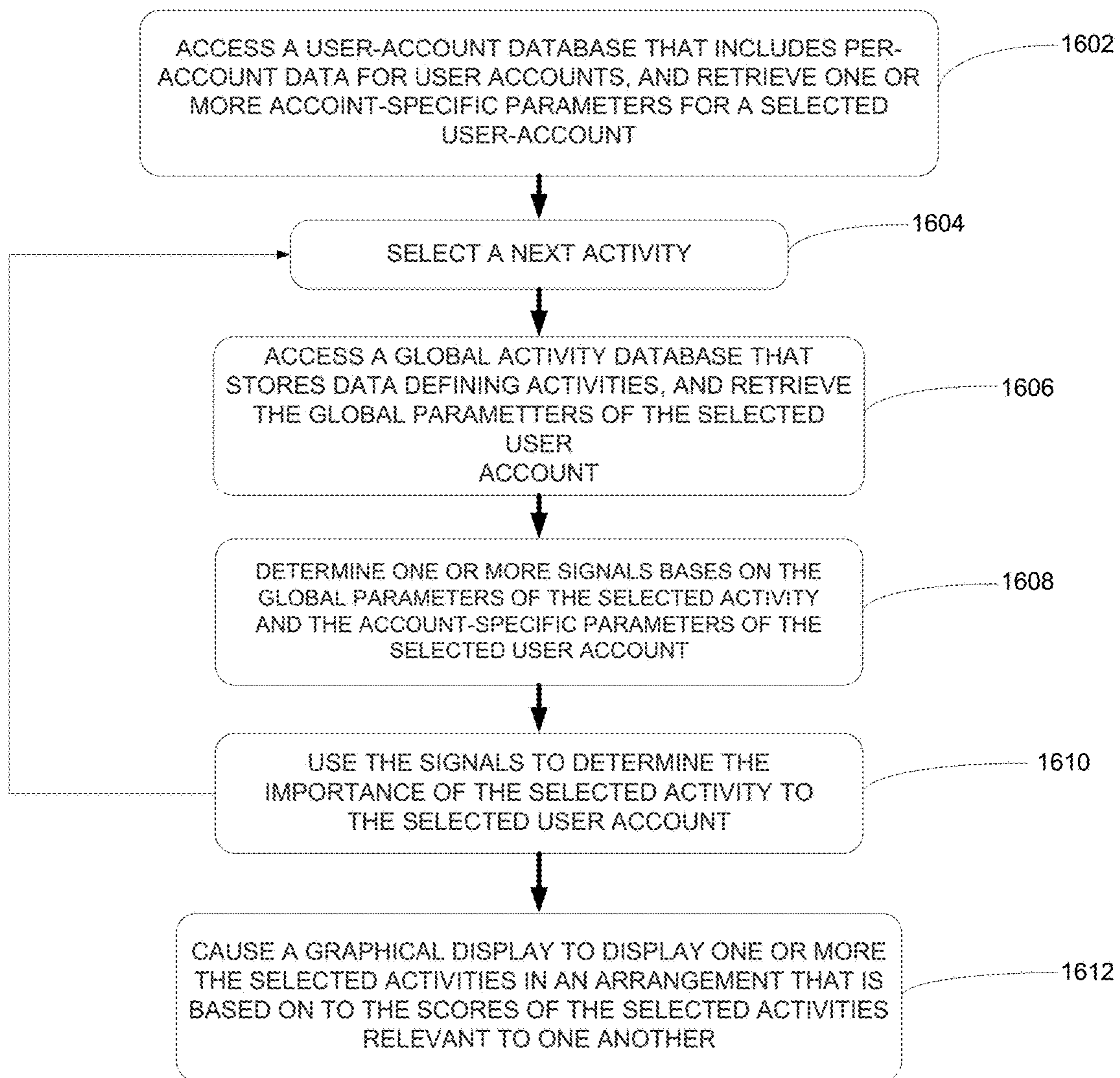


FIG. 30

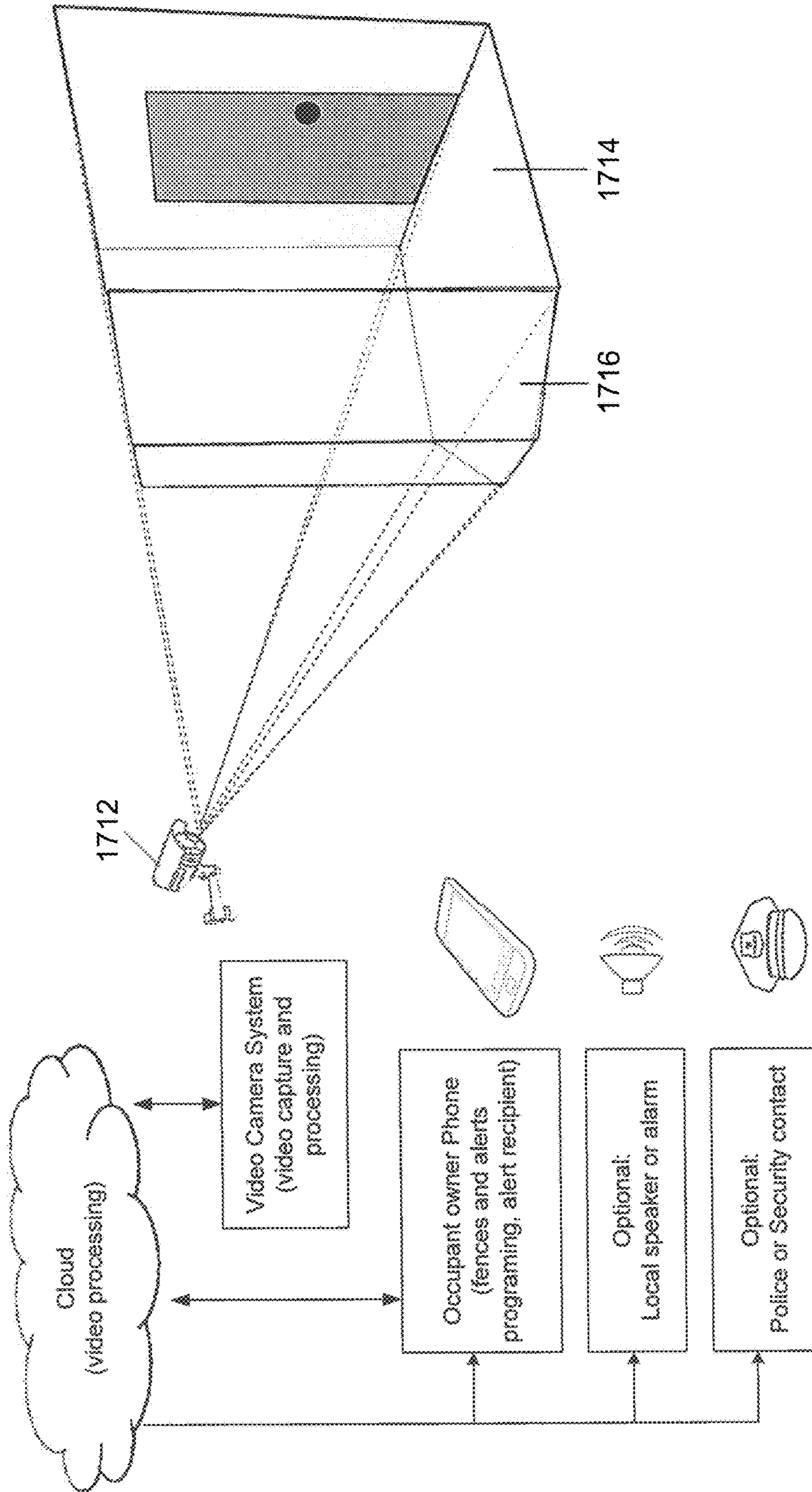


FIG. 31

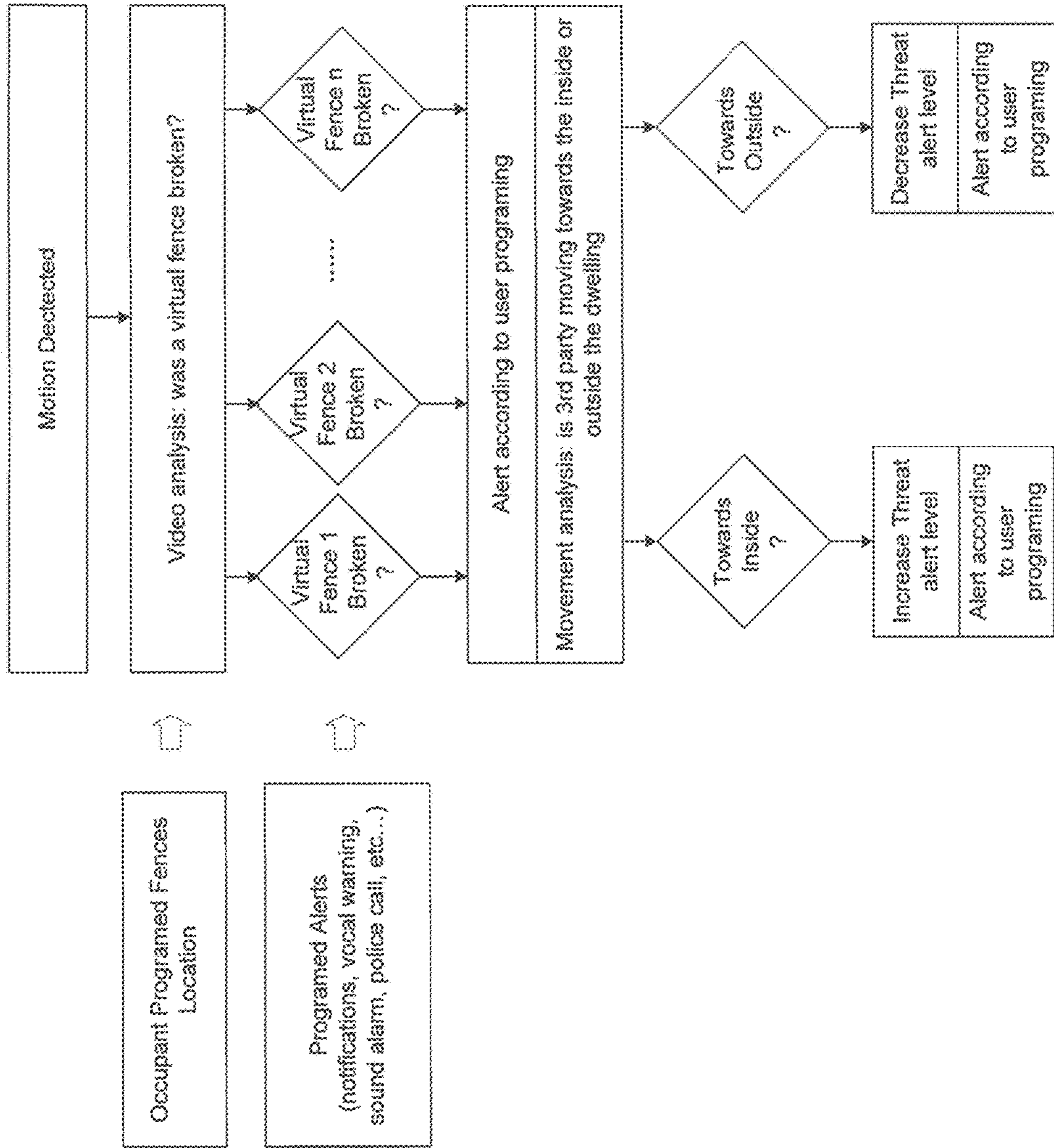


FIG. 32

SWITCH TERMINAL SYSTEM WITH THIRD PARTY ACCESS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the priority benefit of all of the following: which is a Continuation-In-Part of Ser. No. 16/004,341, filed on Jun. 8, 2018, which is a Continuation-In-Part of Ser. No. 16/003,142, filed on Jun. 8, 2018, which is a Continuation-In-Part of Ser. No. 15/940,978, filed on Mar. 30, 2018, which is a Continuation-In-Part of Ser. No. 15/933,611, filed on Mar. 24, 2018, which is a Continuation of Ser. No. 15/924,177, filed on Mar. 17, 2018, which is a Continuation of U.S. Pat. No. 10,146,191, issued on Dec. 4, 2018, which is a Continuation-In-Part of Ser. No. 15/838,371, filed on Dec. 12, 2017, which is a Continuation of Ser. No. 15/835,471, filed on Dec. 8, 2017, which is a Continuation of Ser. No. 15/835,460, filed on Dec. 8, 2017, which is a Continuation of Ser. No. 15/822,109, filed on Nov. 24, 2017, which is a Continuation-In-Part of Ser. No. 15/817,318, filed on Nov. 20, 2017, which is a Continuation of Ser. No. 15/815,729, filed on Nov. 17, 2017, a Continuation of Ser. No. 15/788,823, filed on Oct. 20, 2017, which is a continuation-in-part of U.S. Pat. No. 10,241,477, issued on Mar. 26, 2019, which is a continuation-in-part of U.S. Pat. No. 10,067,484, issued on Sep. 4, 2018, which is a continuation-in-part of Ser. No. 15/681,351, filed on Aug. 19, 2017, which is a continuation-in-part of Ser. No. 15/681,343, filed on Aug. 19, 2017, which is a continuation-in-part of Ser. No. 15/649,683, filed on Jul. 14, 2017, which is a continuation of Ser. No. 15/649,672, filed on Jul. 14, 2017, which is a continuation of Ser. No. 15/649,669 filed on Jul. 14, 2017, which is a U.S. Provisional Patent Application No. 62/416,281, filed on Nov. 2, 2016, which are incorporated herein by reference.

BACKGROUND

Field of the Invention

This invention relates generally to adaptive control systems for a building and more particularly to adaptive control systems that provide third party access.

Brief Description of the Related Art

Electronic control over complex systems has been limited primarily to industrial applications, and occasionally commercial applications. Such electronic control systems usually required extensive and costly equipment, as well as technically trained operators.

However, as consumer products and systems become more and more complex, untrained people in home environments have been increasingly desirous of obtaining a sophisticated electronic control system for enabling an easy to use control over such home products and systems. Many such products and systems are also increasingly being used in commercial environments, such as electronic conference rooms, in which it is also desirable to provide an easy to use control system for use by individuals who are often not skilled in technological arts.

Many building automation systems are generally built around a small control box which is connected by means of existing household AC wiring, to one or more modules distributed throughout the home. The appliances and/or lights to be controlled are in turn connected to the modules

and may thus be controlled from the control console by the homeowner. The main advantage of such “power-line carrier” home control systems is that they are low in cost and utilize existing home wiring. However, such power-line carrier control systems can be easily disrupted by internal circuitry or outside environmental electrical disturbances, such as weather conditions. In addition, such systems allow the control of only a relatively limited number of types of electrical appliances, namely, lights and small electrical appliances. They do not, however, allow for any sophisticated platforming functions other than perhaps a time on and time off feature. This provides power-line carrier control systems are of relatively limited utility for building automation purposes.

More sophisticated building automation systems are generally built around a platform able microprocessor connected to a local bus which accepts a limited number of input/output control cards. Such systems may allow the connection of building occupant control devices such as a keypad or a touchscreen for inputting control commands to the home automation system. However, such systems have a predetermined limited number of how many devices and building occupant interfaces the system can support.

There is a need for systems with controlled third party access to dwellings.

SUMMARY

An object of the present invention is to provide an improved system for controlling one or more switch terminals of a building occupied by one or more building occupants.

Another object of the present invention is to provide a system for controlling one or more switch terminals of a building occupied by one or more building occupants that includes or is coupled to an activity assistant.

Yet another object of the present invention is to provide a system for controlling one or more switch terminals of a building occupied by one or more building occupants that includes or is coupled to an activity assistant that is responsive to a user command.

A further object of the present invention is to provide a system for controlling one or more switch terminals of a building occupied by one or more building occupants that includes or is coupled to an activity assistant that is responsive to a user command which is a voice command.

Still another object of the present invention is to provide a system for controlling one or more switch terminals of a building occupied by one or more building occupants that includes or is coupled to an activity assistant responsive that is responsive to a user command which is a user text.

Another object of the present invention is to provide a system for controlling one or more switch terminals of a building occupied by one or more building occupants that includes or is coupled to an activity assistant where the activity assistant is configured to process a user command.

Yet another object of the present invention is to provide a system for controlling one or more switch terminals of a building occupied by one or more building occupants that includes or is coupled to an activity assistant where a user command is a data construct describing a thing to do.

Still another object of the present invention is to provide a system for controlling one or more switch terminals of a building occupied by one or more building occupants that includes or is coupled to a activity assistant where a command describes an activity.

These and other objects of the present invention are achieved in a system for controlling a first switch terminal of a building occupied by one or more building occupants. The system includes a plurality of switch terminals at the building. A first computer system is coupled to the first switch terminal or equivalent of the building at a first location of the building. The first computer system runs on at least one platform. A first plurality of sensors is coupled to the first switch terminal and the first computer system. At least a portion of the sensors provide signal data to the first computer system. The first computer system produces a command or data output that relates to at least one of: a command output for a local control system, a command output for a different system, a data output for a different system, a command output for a non-local device or a data output that is a non-local device. A second switch terminal includes a second plurality of sensors coupled to a second computer system. An activity assistant is coupled to the system for controlling a first switch terminal.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates one embodiment of a building adaptive control system of the present invention.

FIG. 2 illustrates one embodiment of a switch terminal that can be used with the present invention.

FIG. 3 illustrates one embodiment of a power management system that can be used with the present invention.

FIG. 4 illustrates one embodiment of an integrated computing device that can be used with the present invention.

FIG. 5 illustrates one embodiment of a mesh network that can be used with the present invention.

FIG. 6 illustrates one embodiment of a central light decision engine that can be used with the present invention.

FIG. 7 illustrates one embodiment of an adaptive network that includes two or more switch terminals.

FIG. 8 illustrates one embodiment of a machine intelligence system that can be used with the present invention.

FIG. 9 illustrates one embodiment of an NTB algorithm that can be used with the present invention.

FIGS. 10A-E illustrate one embodiment of a cloud infrastructure that can be used with the present invention.

FIGS. 11-13 illustrate one embodiment of mobile devices that can be used with the present invention.

FIGS. 14-15 illustrate various embodiments of a dual band slot antenna that can be used with the present invention.

FIG. 16 illustrates one embodiment of a switch terminal where there is no specific no specific configuration of the wiring terminals to a specific wiring element/circuit.

FIG. 17 illustrates one embodiment of the present invention with wiring terminals coupled to wiring elements of a switch terminal.

FIG. 18 illustrates one embodiment of a motion detection sensor that is used with the present invention.

FIG. 19 illustrates one embodiment of the present invention with stub wiring terminals coupled to wiring elements of a switch terminal with a locking mechanism.

FIG. 20 illustrates one embodiment of the present invention where knowledge is obtained of how the sensors relate to each other.

FIGS. 21A-E illustrate one embodiment of the present invention where one or more switch terminals include a front module, a radio module, a power module, locking mechanism and a switch terminal back cover.

FIG. 22 illustrates one embodiment of a voice recognition system for identifying voice commands.

FIG. 23 shows a data entry system able to perform speech recognition on data received from remote audio or text entering devices according to one implementation.

FIG. 24 is a schematic diagram of a search server using a speech recognition system to identify, update and distribute information for a data entry dictionary according to one implementation.

FIG. 25 is a flow chart showing exemplary steps for adding data to a speech recognition statistical model.

FIG. 26 is a flow chart showing exemplary steps for adding data to a pronunciation model.

FIG. 27 depicts a network in accordance with an example embodiment.

FIG. 28A is a block diagram of a computing device in accordance with an example embodiment.

FIG. 28B depicts a network with computing clusters in accordance with an example embodiment.

FIG. 29A is a block diagram illustrating features of a user interface, according to an example embodiment.

FIG. 29B is another block diagram illustrating features of a user interface, according to an example embodiment.

FIG. 30 is flow chart illustrating a method according to an example embodiment.

FIGS. 31 and 32 illustrate embodiments of the present invention with third party access.

DETAILED DESCRIPTION

Definitions

As used herein, the term engine refers to software, firmware, hardware, or other component that can be used to effectuate a purpose. The engine will typically include software instructions that are stored in non-volatile memory (also referred to as secondary memory) and a processor with instructions to execute the software. When the software instructions are executed, at least a subset of the software instructions can be loaded into memory (also referred to as primary memory) by a processor. The processor then executes the software instructions in memory. The processor may be a shared processor, a dedicated processor, or a combination of shared or dedicated processors. A typical platform will include calls to hardware components (such as I/O devices), which typically requires the execution of drivers. The drivers may or may not be considered part of the engine, but the distinction is not critical. As used herein, the term database is used broadly to include any known or convenient means for storing data, whether centralized or distributed, relational or otherwise.

As used herein a mobile devices include, but are not limited to, a cell phone, such as Apple's iPhone®, other portable electronic devices, such as Apple's iPod Touches®, Apple's iPads®, and mobile devices based on Google's Android® operating system, and any other portable electronic device that includes software, firmware, hardware, or a combination thereof that is capable of at least receiving a wireless signal, decoding if needed, and exchanging information with a server to send and receive cultural information data including survey data. Typical components of mobile devices may include but are not limited to persistent memories like flash ROM, random access memory like SRAM, a camera, a battery. LCD driver, a display, a cellular antenna, a speaker, a BLUETOOTH® circuit, and WIFI circuitry, where the persistent memory may contain platforms, applications, and/or an operating system for the mobile devices.

As used herein, the term "computing device" is a general purpose device that can be platformed to carry out a finite set

of arithmetic or logical operations. Since a sequence of operations can be readily changed, the computer can solve more than one kind of problem. A computer can include of at least one processing element, typically a central processing unit (CPU) and some form of memory. The processing element carries out arithmetic and logic operations, and a sequencing and control unit that can change the order of operations based on stored information. Peripheral devices allow information to be retrieved from an external source, and the result of operations saved and retrieved. Computer also includes a graphic display medium.

As used herein, the term “Internet” is a global system of interconnected computer networks that use the standard Internet protocol suite (TCP/IP) to serve billions of building occupants worldwide. It is a network of networks that consists of millions of private, public, academic, business, and government networks, of local to global scope, that are linked by a broad array of electronic, wireless and optical networking technologies. The Internet carries an extensive range of information resources and services, such as the inter-linked hypertext documents of the World Wide Web (WWW) and the infrastructure to support email. The communications infrastructure of the Internet consists of its hardware components and a system of software layers that control various aspects of the architecture.

As used herein, the term “extranet” is a computer network that allows controlled access from the outside. An extranet can be an extension of an organization’s intranet that is extended to building occupants outside the organization in isolation from all other Internet building occupants. An extranet can be an intranet mapped onto the public Internet or some other transmission system not accessible to the general public, but managed by more than one company’s administrator(s). Examples of extranet-style networks include but are not limited to: LANs or WANs belonging to multiple organizations and interconnected and accessed using remote dial-up LANs or WANs belonging to multiple organizations and interconnected and accessed using dedicated lines Virtual private network (VPN) that is comprised of LANs or WANs belonging to multiple organizations, and that extends usage to remote building occupants using special “tunneling” software that creates a secure, usually encrypted network connection over public lines, sometimes via an ISP.

As used herein, the term “Intranet” is a network that is owned by a single organization that controls its security policies and network management. Examples of intranets include but are not limited to: A LAN A Wide-area network (WAN) that is comprised of a LAN that extends usage to remote employees with dial-up access A WAN that is comprised of interconnected LANs using dedicated communication lines A Virtual private network (VPN) that is comprised of a LAN or WAN that extends usage to remote employees or networks using special “tunneling” software that creates a secure, usually encrypted connection over public lines, sometimes via an Internet Service Provider (ISP). For purposes of the present invention, the Internet, extranets and intranets collectively are referred to as (“Network Systems”).

As used herein “load management” is defined as the process of balancing the supply of electricity with an electrical load by adjusting or controlling the load rather than the power station output. As used herein an electrical load is an electrical component or portion of a circuit that consumes electric power. This is opposed to a power source, such as a battery or generator, which produces power. In electric power circuits examples of loads are appliances and lights.

The term may also refer to the power consumed by a circuit. Electrical load includes a system or device connected to a signal source, whether or not it consumes power. If an electric circuit has an output port, a pair of terminals that produces an electrical signal, the circuit connected to this terminal (or its input impedance) is the load. An electrical load can affect the performance of circuits with respect to output voltages or currents, such as in sensors, voltage sources, and amplifiers.

As used herein a “building” is anything built or constructed including but not limited to a structure that is a relatively permanently enclosed construction over a plot of land, having a roof and usually windows. Examples of buildings include but are not limited to: agricultural buildings, commercial buildings, residential buildings, medical buildings, educational buildings, government buildings, industrial buildings, military buildings, parking structures and storage, religious buildings, transport buildings, and the like.

As used herein “integrated” means composed to form a complete or coordinated entity that can be combined, coupled to, coordinating, separate elements coupled to each other and the like.

As used herein “machine learning” is artificial intelligence and relating to construction and studies of systems that can learn from data. Machine learning can give computation devices including but not limited to computers with an ability to learn without being explicitly platformed. And can evolve from pattern recognition and computational learning theory in artificial intelligence. As a non-limiting example machine learning explores the study and construction of algorithms that can learn from and make predictions on data. As a non-limiting example these algorithms can overcome following strictly static platform instructions by making data-driven predictions or decisions and can build a model from sample inputs. Platforms include computational statistics, as well as mathematical optimization. Machine learning can be unsupervised and be used to learn and establish baseline behavioral profiles for various entities and then used to find meaningful anomalies. For purposes of the present invention machine learning collectively is called “machine intelligence

As used herein “local installed platform” means” a software platform that can be a local installed platform is software that works in combination with the hardware. In one embodiment the local installed platform is in communication with raw data that can be received from a sensor, a command input or data input to generate device behaviors. As non-limiting examples the device behaviors can be commands and/or data outputs.

Referring to FIG. 1 in one embodiment a building adaptive control system **10** for a building. (hereafter system “10”) is provided for controlling a first switch terminal **12** or equivalent of a building **25** occupied by one or more building occupants. As used herein switch terminal or equivalent includes both the switch terminal **12** or equivalent includes switch terminal system, hereafter collectively called (“switch terminal **12** or equivalent”). The system **10** includes a plurality of switch terminal parameters relative to the building **25**. A first computer system **14** is coupled to the first switch terminal **12** or equivalent of the building **25** at a first location of the building **25**. The first computer system **14** runs on at least one platform. A first plurality of sensors **15** are coupled to the first switch terminal **12** or equivalent and the first computer system **14**. At least a portion of the sensors **15** provide signal data to the first computer system **14**. The first computer system **14** produces a command or

data output that relates to at least one of: a command output for a local control system, a command output for a different system, a data output for a different system, a command output for a non-local device or a data output that is a non-local device, each of an output including learned data from that is based on a machine intelligence from previous data collected about patterns of a building occupant.

In various embodiments, switch terminal **12** or equivalent is configured to provide one or more platforms for an occupant of a building **25** using machine learning relative to a switch terminal **12** or equivalent in response to an activity or a behavior of a building occupant or a characteristic of the building itself. (Collectively a “building occupant switch terminal parameter”).

In one embodiment an intelligent lighting system **10** is provided. In one embodiment the lighting system **10** includes a first switch terminal **12** or equivalent, or a device that can provide communication between different components of system **10** (hereafter an “equivalent”). As a non-limiting example the building **25** is occupied by one or more building occupants. In one embodiment the system **10** includes a plurality of switch terminal **12** or equivalent parameters relative to the building. In one embodiment a first computer system **14** is coupled to the first switch terminal **12** or equivalent of the building **25** at a first location of the building **25**. As a non-limiting example the first computer system **14** with one or more software platforms, hereafter platform, that runs on a computer system **14**. System **10** is the first or local system, and it can be coupled to one or more non-local or third party systems **10**.

In one embodiment a first plurality of sensors (collectively **15**) are coupled to the first switch terminal **12** or equivalent and the first computer system **14**. All or a portion of the sensors **15** can be internal or external to switch terminal **12** or equivalent. As a non-limiting example each or a portion of the sensors **15** is configured to provide signal data to the first computer system **14**. As a non-limiting example suitable sensors **15** including but not limited to IR sensors; image sensors; ambient light sensors; microphones; proximity sensors; RGB sensors; humidity sensors; temperature sensors; carbon monoxide sensors; radar based sensors; laser measuring sensors; RF sensors; accelerometers) and the like;

The first computer system **14** produces a command or data output that relates to at least one of: a command output for a local control system **16**, a command output for a different control system, also **16**, which can be included in system **10** or second system **10**, a data output for a second system **10**, a command output for a non-local or local device **18** that is can be included or not included in system **10**, and a data output that is for a non-local device **18**. In one embodiment each or at least a portion of an output includes learned data from that is based on machine intelligence from previous data collected about patterns of a building occupant and the building itself.

In one embodiment device **18** is a hardware or software component. Device **18** can be a local device **18** at the first system **10** or a non-local device **18** that is external to first system **10** and can be included in a second system (third party system), also referred to as system **10**. In one embodiment second system **10** is in communication with system **10**, or at least a portion of second system **10** is in communication with system **10**.

In one embodiment a device **18** is a physical or software element that provides for communication and interaction in system **10**. As a non-limiting example devices include but are not limited to: gateways, routers, network bridges,

modems, wireless access points, networking cables, line drivers, switches, hubs, and repeaters; and may also include hybrid network devices such as multilayer switches, protocol converters, bridge routers, proxy servers, firewalls, network address translators, multiplexers, network interface controllers, wireless network interface controllers. ISDN terminal adapters, other related hardware and the like.

In one embodiment at least one interface **20**, FIG. **4**, is coupled to the first switch terminal **12** or equivalent and the first computer system **14** is configured to receive a command input. In one embodiment, at least one building occupant interface **20**, hereafter interface **20**, is a point of interaction between a computer system **14** and humans. In one embodiment interface **20** includes any number of modalities of interaction (such as graphics, sound, position, movement, etc.) where data or other information is transferred between the building occupant and computer system **14**. As non-limiting examples an interface **20** includes but it not limited to: at least one of: a touch interface, a voice interface, a communication interface **20**, a wireless interface **20**, a wireless radio interface **20** and the like.

As a non-limiting example the building occupant enters a change in a switch terminal **12** or equivalent parameter using the at least one interface **20**. In one embodiment the first switch terminal **12** or equivalent is configured to receive from a second switch terminal **12** or equivalent a data output that is used to create a command output that relates to the first switch terminal **12** or equivalent or a non-local device **18**.

In one embodiment the signal data is raw signal data. In one embodiment at least a portion of the sensors **15** receive raw sensor data.

As a non-limiting example the building occupant is a person who has access rights to the building **25**. In one embodiment the building occupant does not occupy the building **25** at all times of a selected time period. In one embodiment the building occupant enters and exits the building **25**.

In one embodiment a command is an instruction for a specific device **18** to take an action.

As a non-limiting example the specific device **18** is the switch terminal **12** or equivalent.

As non-limiting examples the command is provided from at least one of: a mobile device **23**, a cloud system **21**, an input to the specific device **18** and the like. In one embodiment the command is provided by using a touch screen, also referred to as **20**, of a switch terminal **12** or equivalent that serves as a means for input of data, a command and the like.

In one embodiment the command is provided by the building occupant.

In one embodiment a data input is provided to at least a portion of the sensors **15**.

As non-limiting examples the data input is selected from at least one of: a processed sensor input from another device **18** that is relevant to the system **10** In one embodiment, another device **18** can be included in system **10**, second system **10**, and the like. As non-limiting examples data can come from another device **18**, which can be from system **10** or a separate system **10**. Input can be entered through at least one: a building occupant’s voice, a touch screen display, a touch sensor, a physical mechanism, components used to connect computers or other electronic devices together so that they can share files or resources, and the like.

In one embodiment an intelligent lighting system **10** is provided. In one embodiment the intelligent lighting system **10** controls a first switch terminal **12** or equivalent of a building **25** occupied by one or more building occupants. In

one embodiment the system **10** includes a plurality of switch terminal **12** or equivalent parameters relative to the building **25**. In one embodiment a first computer system **14** is coupled to the first switch terminal **12** or equivalent of the building at a first location of the building. As a non-limiting example the first computer system **14** runs on at least one platform.

In one embodiment a first plurality of sensors **15** are coupled to the first switch terminal **12** or equivalent and the first computer system **14**. As a non-limiting example each or a portion of the sensors **15** is configured to provide signal data to the first computer system **14**. The first computer system **14** produces a command or data output that relates to at least one of: a command output for a local device **18**, a command output from a third party system **10**, a command output for a non-local device **18** and a data output that is a non-local device **18**. In one embodiment each or at least a portion of an output includes learned data from that is based on machine intelligence from previous data collected about patterns of a building occupant.

As a non-limiting example the building occupant enters a change in a switch terminal **12** or equivalent parameter using the at least one interface **20**. In one embodiment the first switch terminal **12** or equivalent is configured to receive from a second switch terminal **12** or equivalent a data output that is used to create a command output that relates to the first switch terminal **12** or equivalent or a non-local device.

In one embodiment the signal data is raw signal data. In one embodiment at least a portion of the sensors receive raw sensor data.

As a non-limiting example the building occupant is a person who has access rights to the building **25**. In one embodiment the building occupant does not occupy the building **25** at all times of a selected time period. In one embodiment the building occupant enters and exits the building **25**.

In one embodiment a command is an instruction for a specific device **18** to take an action. As a non-limiting example the specific device **18** is the switch terminal **12** or equivalent.

As non-limiting examples the command is provided from at least one of: a mobile device, a cloud system **21**, a third party system, or an input to the specific device

In one embodiment the command is provided using a touch screen of a switch terminal **12** or equivalent interface **20**.

In one embodiment the command is provided by the building occupant.

In one embodiment a data input is provided to at least a portion of the sensors **15**.

As non-limiting examples the data input is selected from at least one of: a processed sensor input from another device **18** that is relevant to the system **10**, a third party system **10** in communication with the first system **10**, and the like.

As non-limiting examples the data input is selected from at least one of the following: a processed sensor **15** input from another device **18** that is within the local system **10**; a processed sensor **15** input from another device **18** that is part of a separate system **10** (third party system), a processed sensor **15** input from another device **18** that may be relevant to system **10**, a third party system **10** in communication with the first system **10**, and the like. As non-limiting examples switch terminals **12** can include: switch terminals **12**; electrical outlets; light sources, lamps; thermostats; cameras; smoke detectors; door locks; smart televisions; set top boxes; routers; wireless access points; mobile devices and the like, (hereafter collectively "switch terminals **12**").

As non-limiting examples the output command is to the switch terminal **12** or equivalent. In one embodiment the output command is to a system **10** device **18** other than the switch terminal **12** or equivalent.

In one embodiment the output command is provided to the second system **10**.

As non-limiting examples the data input can be any data and can include at least one of: a building occupant's presence or use in a room; a light level; system information relative to a switch terminal **12** or equivalent. As non-limiting examples the data input can be any data and can include at least one of: a measurement; a classification; a determination based on logic; an announcement with regard to any aspect of a state being held, and the like.

As non-limiting examples the data input can be any data that can relate to at least one of: the environmental conditions of an area inside or proximate to a building **25**; the number and identity of occupants inside or proximate to the building **25**; the activities of building occupants; the performance and state of the electrical system of a building; the performance and state of any power supply connected to the building **25**; the functions of any system within the building **25** and the like.

In another embodiment the intelligent lighting system controls at least two switch terminals **12** of the building **25** occupied by one or more building occupants and the system including a plurality of switch terminal **12** or equivalent parameters relative to the building **25**. A first computer system **14** coupled to a first switch terminal **12** or equivalent of the building **25** at a first location of the building **25**, the first computer system **14** running on at least one platform. A second computer system **14** is coupled to a second switch terminal **12** or equivalent of the building **25** at a second location of the building **25**. In one embodiment the second computer system **14** runs on at least one platform. In another embodiment the second computer system **14** runs on a different platform. The first and second computer systems **14** are in communication with each other. A first plurality of sensors is coupled to the first switch terminal **12** or equivalent and the first computer system **14** and a second plurality of sensors is coupled to the second switch terminal **12** or equivalent and the second computer system **14**. Each of a sensor **15** is configured to provide signal data to the first or second computer systems **14** respectively. Each of the first and second computer systems **14** produces a command or data output that relates to at least one of: a command output for a local control system **16**, a command output for a different system, a data output for a different system, a command output for a non-local device **18** or a data output that is a non-local device. Each of an output includes learned data from that is based on machine intelligence from previous data collected about patterns of a building occupant.

In one embodiment at least one interface **20** is coupled to the second switch terminal **12** or equivalent and the second computer system **14** is configured to receive a command input.

In one embodiment the first switch terminal **12** or equivalent and second switch terminal **12** or equivalent are configured to receive from each other a data output that is used to create a command output that relates to the first switch terminal **12** or equivalent, the second switch terminal **12** or equivalent or a non-local device.

In one embodiment the specific device **18** is the first or second switch terminal **12** or equivalent.

In one embodiment the output command is to at least one of the first and switch terminal **12** or equivalent interfaces **20**.

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In one embodiment the output command is to a system device **18** other than the first or second switch terminal **12** or equivalent.

In one embodiment, the system **10** is provided for one or more rooms, as well as non-rooms such as hallways and the like, in a building **25** that includes one or more load controlling device **18** each coupled with a computing device **14**. In one embodiment computing device **14** is integrated with a load controlling device **18**. In one embodiment switch terminal **12** or equivalent are provided. In one embodiment system **10** that allows for a range of functions to be achieved via an interaction with the one or more of the following: controlled loads, first party devices **18** including among others additional switch terminal **12**, mobile phones **23** with first party applications running on them, a third party cloud **21**, as illustrated in FIG. **1**, the first party's back end instead of cloud **21**, third party devices **18** or services, mobile devices **23** and the like.

In various embodiments databases **27** relative to a building occupant switch terminal parameter are provided. There can be multiple databases **27** across devices **18** in system **10**, associated with one or more terminal switches, in the cloud **21**, at a switch terminal backend, and the like. In one embodiment the one or more databases **27** includes a receiving device that includes a database of building occupant switch terminal parameters. The database receives information from the sensors **15** At least a portion of the building occupant switch terminal parameters are processed. In one embodiment the sensors **15** provide information relating to the building occupant switch terminal parameter that is stored in the database **27**. In one embodiment the sensors **15** wirelessly communicate via at least one communication route with a server that is in communication with the database **27**. In one embodiment a building occupant switch terminal parameter classification system is used. The server uses one or more processors to process the building occupant switch terminal parameter information from the sensors **15**.

As non-limiting examples switch terminal parameters include but are not limited to: electrical performance of different electrical loads controlled by the system **10** for optimal dimming performance; the monitoring of the health of the electrical loads; the preferred lighting levels of occupants throughout the day and year; the activity patterns of building occupants; how building occupants prefer their lighting based on different activity patterns; how natural light impacts different rooms within a building; when people go to sleep; how many people regularly occupy a building; the individual preferences that are held by different people who regularly occupy the building; generalized personas that represent people that regularly occupy the building; the distinct voice characteristics of different individuals inside the building; the common patterns of usage of different internal areas of the building **25**, persona identification; space mapping; lighting personas that are portable; switch(es) only features or switch(es) plus cloud; calls; intercom; load control calibration; electrical load monitoring; hearing impaired features; WiFi repeating; third party activities such as guest mode; reporting on energy savings; eco mode; direct connection to a device **18**; advertising based on the data; mobile app interacting; switch setup; mobile devices **23** setup; mobile devices **23** calibration; intelligent grouping; mobile devices **23** ordering of switches by distance in the app; method for opportunistically transferring data and platform via phone including but not limited to a mobile devices **23**; snapshot feature; applications on a switch by a first, second, third party and the like; selectably

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managed; selectably installed or deleted; applications on the switch **12** by back-end **17** and/or cloud **21** a first, and the like; selectably installed or deleted; other devices/services interacting with the switch **12**, including but not limited to building **25** wake up; other devices/services and the like; coordination with light sources to deliver a desired light spectrum; and the like.

In one embodiment system **10** uses platforms that are used by system **10** to build adaptive control systems **10** by using building occupant switch terminal parameters

As non-limiting examples, platform algorithms include but are not limited to: NIB, Linear Regression, Logistic Regression, Decision Tree, SVM, Naïve, Bayes, KNNK-Means, Random Forest, Dimensionality Reduction, Algorithms Gradient Boost & Ad boost, and Linear Regression

System **10** can include switch terminal **12** or equivalent, other first party devices **18** including additional switch terminals **12** or equivalent, mobile devices **23** in communication with system **10**, first party or third party applications, Network Systems **25**, a router **24**, one or more bridge **26**. In various embodiments, system **10** provides a load controlling device **18** or system **22** included with a computing device **14** that can be integrated with load controlling device **18** to create a switch terminal device **12** or system **12**. The switch terminal **12** or equivalent can include a power source, an electrical circuit **28**, at least one electrical load in addition to the switch terminal **12** or equivalent. As a non-limiting example bridge **24** can provide any number of different types of communication including but not limited to, Bluetooth, Bluetooth Low Energy BLE and sub-GHz band; local and distributed protocols for establishing a communication system RF, WiFi, and the like as more fully discussed hereafter.

In one embodiment system **10** is coupled to a third party system **10**, third party devices **18** or services accessible via the Network Systems **25**, one or more mobile devices **23**, and the like.

As illustrated in FIG. **2** in one embodiment the switch terminal **12** or equivalent includes wiring components **30** that are coupled to existing circuitry wiring **31**, a power management system **32** and computing device **14**. In other embodiment additional devices **18** can be included.

As illustrated in FIG. **3** in one embodiment power management system **32** can include a Micro Controller Unit MCU **34**, a form of local energy storage **38**, a load control system **22**, which can be dynamic, one or more locally executable platforms located on the included MCU **34** and an electrical circuit characteristic measurement system **32**. In one embodiment the integrated computing device **14** includes the MCU **34**, a memory system **42** for persistent storage **44**, a set of locally executable platforms located MCU **34** and provided by backend **17**, cloud **21** and/or a network connectivity platform **46**.

As illustrated in FIG. **4** in one embodiment the integrated computing device **14** includes one or more of; one or more building occupant interface **20** elements including but not limited visual displays **48**, touchscreen **50**, LEDs **52**, speakers **54**, tactile buttons **56**, voice recognition interfaces **58** and haptic engines **60**, one or more sensors **16** and the like.

In one embodiment one or more additional processor components **62** are provided including but not limited to CPUs, GPUs, and DSPs; one or more additional platforms provided by backend **17** and/or cloud **21** and loaded locally onto the computing device **14** for local execution to achieve additional functionality including but not limited to, matching learning, lighting related objectives, one or more networking technologies including but not limited to Wifi, Bluetooth, BLE and sub-GHz band; local and distributed

protocols for establishing a communication system or method **64** between first and third party devices **18** or services with each other. As a non-limiting example a mesh network **64** can be used.

As illustrated in FIG. **5** in one embodiment one or more integrated computing devices **14** optionally communicate with one another when present over one or more mesh networks **64**. In one embodiment the mesh network **64** can be created over WiFi, sub-GHz, we well as any type of system or method **64** that allows communication between first and third party devices **18** or services with each other, and the like As A non-limiting example mesh network **64** allows a range of different message types to be transferred between individual computing devices **14** including but not limited to messages that can include data or command inputs for devices **18** other than the device **18** transmitting it.

In one embodiment system **10** uses one or more platforms. In one embodiment a network-transmission-based (NTB) algorithm is utilized.

In one embodiment of the power management system **32**, when power is detected on the electrical circuit **28**, the included MCU **34**, the locals installed on that MCU **34**, and the lighting circuit measurement system **50** can combine to identify, if present, the types of electrical lighting loads, other than the switch terminal **12** or equivalent, that are present on that circuit to allow for differential treatment of those loads.

In one embodiment of the power management system **32**, when power is detected on the electrical circuit **28**, the included MCU **34**, the one or more platforms **14** installed on that MCU **34**, and the lighting circuit measurement system **50** can combine to identify, if present, the specific models of electrical lighting loads that are present on that circuit by matching their observed characteristics and matching them to previously recorded fingerprints for other units of the same model to allow for differential treatment of those loads.

In one embodiment a load characterization algorithm is utilized in combination with memory by assessing the manner by which an attached load consumes power from a controlled circuit. As a non-limiting example this can be achieved by executing a calibration procedure that uses a sequence of opening and closing the circuit to measure and asses electrical characteristics including but not limited to the circuit's power factor, real and apparent power usage, the amount of current that is necessary to generate resistance in the circuit, the timing of in-rush current phases. Once the nature of the characteristics is determined the system can classify an attached load and appropriately control its power. In one embodiment this may or may not result in the enablement of dimming features for the load. If dimming features are enabled then further characterization of the dimming properties of the circuit is completed to provide an automatic configuration of the circuit for the computing device **18** to use in controlling the load and limiting need to require the building occupant to configure the system directly.

In one embodiment power management system **32** identifies the types of electrical lighting loads present.

In one embodiment of the power management system **32**, after identifying the types of electrical lighting loads present. As a non-limiting example MCU **34**, the one or more platforms **14** installed on that MCU **34**, and the dynamic load control system **16** can combine with instructions received from another source including but not limited to a building occupant of the system, a networked device **18** or a cloud service to optimally limit the power flowing through the electrical circuit **28** to the loads to among other functions

allow for the widest range of dimming for those electrical lighting loads, to ensure that the loads are not compromised by inappropriate current on the line, to eliminate flickering for the electrical lighting loads by appropriately cutting the electrical sine-wave, and identify when loads have failed.

In one embodiment of the power management system **32**, the included MCU **34**, the one or more platforms installed on that MCU **34**, and the dynamic load control system **16** can combine with the integrated computing device **14** to monitor the health of the loads attached to the electrical circuit **28**. If this monitoring results in a determination either by the power management system **32** or the integrated computing device **14**, or a combination of those two elements that one or more of the electrical lighting loads has failed or is likely to fail, than a notification can be sent via the network connectivity platform **46** to a building occupant that can take some action based on this information.

In one embodiment of the power management system **32**, the included MCU **34**, the one or more platforms installed on that MCU **34**, the dynamic load control system **16** and the energy storage **38** can combine to ensure in cases where there is a neutral wire available for connecting in the electrical circuit **28**, that (a) the switch terminal **12** or equivalent including both the power management system **32** and the integrated computing device **14** maintains sufficient power to operate when the electrical circuit **28** is closed and the electrical loads are powered, (b) that the switch terminal **12** or equivalent maintains sufficient power to operate when the electrical circuit **28** is open and the electrical loads are unpowered and (c) the switch terminal **12** or equivalent maintains sufficient power to operate when there is now power at all in the electrical circuit **28**.

In one embodiment of the power management system **32**, the included MCU **34**, the one or more platforms installed on that MCU **34**, the dynamic load control system **22** and the energy storage **38** can combine to ensure in cases where there is not a neutral wire available for connecting in the electrical circuit **28**, that (a) the switch terminal **12** or equivalent including both the power management system **32** and the integrated computing device **14** maintains sufficient power to operate when the electrical circuit **28** is closed and the electrical loads are powered, (b) that the switch terminal **12** or equivalent maintains sufficient power to operate when the electrical circuit **28** is open and the electrical loads are unpowered and (c) the switch terminal **12** or equivalent maintains sufficient power to operate when there is now power at all in the electrical circuit **28**.

In one embodiment of the power management system **32**, when power fluctuates on the electrical circuit **28**, creating what is sometimes called dirty loads, one or more of the included MCU **34**, the one or more platforms installed on that MCU **34**, the dynamic load control system **16** and the lighting circuit measurement system **66** can combine to smooth out the variability in the electrical frequency coming from the source to deliver a more stable frequency to the electrical loads. In one embodiment this operation can thus eliminate or greatly reduce the visible flickering of electrical lighting loads visible to building occupants/humans.

In one embodiment one or more sensors **15** is utilized to determine whether there is occupancy or activity in the room, or any other area of building **25**, based on the sensors **15** specific methodology. When a reading is registered on the sensor **15**, that singular input is combined with the one or more platforms installed on the device **18** to make a determination of whether the perceived signal qualifies as a presence event. This event and its characterization can then

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be immediately used by other platforms installed on the integrated computing device **14** for various purposes related to the inventions operation.

In one embodiment the integrated computing device **14** can additionally include two or more one sensor **15**. These are utilized to determine whether there is occupancy or activity in the room based on the multitude sensors specific methodologies. In one embodiment when a reading is registered one at least one of the sensors **15**, the readings for all included sensors **15** can be individually evaluated and then merged to create a unified data signal representing all of the sensors **15** in use. This multi-modal input is combined with the one or more platforms installed on the device **18** to make a determination of whether the perceived signal qualifies as a presence event. This event and its characterization can then be immediately used by other platforms installed on the integrated computing device **14** for various purposes related to the inventions operation.

In one embodiment the integrated computing device **14** can additionally include and at least one sensor **15**. These are utilized to determine whether there is occupancy or activity in the room based on the sensors **15** specific methodology. When a reading is registered on the sensor **15**, that singular input is combined with the one or more platforms installed on the device **18** to make a determination of whether the perceived signal qualifies as a presence event.

As a non-limiting example, this event, it's characterization and the raw data recorded from the sensor or sensors **15** relating to that event can then be saved to the storage system **54** so that it can be utilized later by the locally installed platforms, or transferred via Network Systems **15** to other similar first party devices **18**, to mobile devices **23**, to cloud **21**, to third party devices **18** or services accessible via Network and the like.

In one embodiment the integrated computing device **18** can additionally include two or more sensors **15**, which can be internal or external to computing device **14**. These are utilized to determine whether there is occupancy or activity in the room based on the multitude sensors **15** specific methodologies as more fully explained hereafter.

When a reading is registered with at least one of the sensors **15**, the readings for all included sensors **15** can be evaluated and then merged to create a unified data signal representing all of the sensors **15** in use. This multi-modal input is combined with the one or more platforms installed on the device **18** to make a determination of whether the perceived signal qualifies as a presence event.

This event, it's characterization and the raw data recorded from the sensors **15** relating to that event can then be saved to the storage system **54** so that it can be utilized later the locally installed platforms, or transferred via a network connectivity method to other similar first party devices **18**, to mobile devices **23**, to cloud system **21**, to first party's back-end, to third party devices **18** or services accessible via Network Systems.

In one embodiment the integrated computing device **14** can additionally include and at least one sensor **15**. These are utilized to determine whether there is an absence of occupancy or activity in the room based on the sensors **15** specific methodology. When a reading is registered on the sensor **15**, that singular input is combined with the one or more platforms installed on the device **18** to make a determination of whether the perceived signal qualifies as an absence of presence event. This event and its characterization can then be immediately used by other platforms installed on the integrated computing device **14** for various purposes related to the system **10** operation.

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In one embodiment the integrated computing device **14** can additionally include two or more sensors **15**. These are utilized to determine whether there is an absence of occupancy or activity in the room based on the multitude sensors **15** specific methodologies. When a reading is registered one at least one of the sensors **15**, the readings for all or a portion of the sensors **15**, which may be at switch terminal **12** or equivalent or external to switch terminal, are individually evaluated and then merged to create a unified data signal representing all the readings from the all or portion of the sensors **15** that have been used.

This multi-modal input is combined with the one or more platforms installed on the device **18** to make a determination of whether the perceived signal qualifies as an absence of presence event, this event and its characterization can then be immediately used by other platforms installed on the integrated computing device **14** for various purposes related to switch terminal **12** operation, building occupant switch terminal parameters

In one embodiment the integrated computing device **14** can additionally include and at least one sensor **15**. These are utilized to determine whether there is an absence of occupancy or activity in the room based on the sensors **15** specific methodology.

As a non-limiting example when a reading is registered on the sensor **15**, that singular input is combined with the one or more platforms installed on the device **18** to make a determination of whether the perceived signal qualifies as an absence of presence event. This event, it's characterization and the raw data recorded from the sensor or sensors **15** relating to that event can then save to the storage system **54** so that it can be utilized later the locally installed platforms, or transferred via a network connectivity method **58** to other similar first party devices **14**, to mobile devices **23**, to first party back-end, cloud **21**, third party devices **18** via the Network Systems.

In one embodiment the integrated computing device **14** can additionally include two or more sensors **15**. As a non-limiting example these can be used to determine whether there is an absence of occupancy or activity of a building occupant in the room or any portion of building **25** based on the multitude sensors **15** specific methodologies. When a reading is registered one at least one of the sensors **15**, the readings for all included sensors **15** is individually evaluated and then merged to create a unified data signal representing all of the sensors **15** in use. This multi-modal input is combined with the one or more platforms installed on the device **18** to make a determination of whether the perceived signal qualifies as an absence of presence event.

This event, it's characterization and the raw data recorded from the sensors **15** relating to that event can then be saved to the storage system **44** so that it can be utilized later the locally installed platforms, or transferred via a network connectivity method to cloud system **21**, backend **17** to mobile devices **23**, to first party controlled cloud service **20**, to third party controlled cloud services **22**, accessible via the Network Systems **25**.

In one embodiment the integrated computing device **14**, in combination either the one or more platforms installed on the device **18** or any platforms or platforms available on one or a combination of other similar first party devices **18**, mobile devices **23**, first party controlled cloud services **17**, devices **18** and the like accessible via the Network Systems **25** that communicate with a single integrated computing device **14** via a network connectivity method, can dynamically adjust the available characteristics for a sensor **15** or group of sensors **15** to modify the combinations determina-

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tion of whether presence and activity events or the absence of presence and activity are observed.

In one embodiment, the switch terminal **12** or equivalent can use one or more sensors **15** to scan a three dimensional space of building **15**. The switch terminal **12** or equivalent can combine signals from the sensor or sensors **15** with local installed platforms to make determinations as to the existence or absence of presence or activity in that space, determine the nature or characteristics of the presence or activity in that space by a building occupant and independently decide how to alter its function based on that determination.

In one embodiment, the switch terminal **12** or equivalent can utilize its ability to scan a three dimensional space and determine the existence or absence of presence of activity in that space to independently decide how to control an electrical lighting circuit **14**. The dimensions of how the switch terminal **12** or equivalent controls the circuit **16**, including but not limited to a light circuit **16**, can thus be a result of its interpretation of a multitude of signals and other contextual factors to create an control system living experience, which can be as a non-limiting example an adaptive control system experience, that provides for the, local determination of lighting states based on what is specifically happening in a three dimensional space observed by a particular switch terminal **12** or equivalent.

In one embodiment, the switch terminal **12** or equivalent may have more than one local installed platforms executing simultaneously on its integrated computing device **14** that each are independently assessing a single signal from a sensor **15** or a multitude of signals from more than one sensor **15** to the end of each making their own independent decision about how the lighting environment as controlled by the electrical circuit **28** to which that switch terminal **12** or equivalent is attached should adapt to meet a predetermined state based on their independent assessments as to the existence or absence of presence or activity, including but not limited to that of a building occupant, in a space of building **25**, or the nature of the existence or absence of presence or activity in that space.

When more than one platforms attempt to change the state of the switch terminal **12** or equivalent control of the electrical lighting circuit **14**, another third local installed platform will be executed to determine which of the platforms may control the state of the switch terminal **12** or equivalent circuit control. This central lighting decision engine **66** can assess a range of attributes included in platforms attempt to change the state of the power management system **32**, the means by which a switch terminal **12** or equivalent controls the electrical lighting circuit **14** to which it is attached, and determine how the attempts should be applied to the power management system **32**.

In one embodiment, the switch terminal **12** or equivalent, while observing a three dimensional space of building **25**, may have one or more local installed platforms determine that their local interpretation of the signals collected via one or more sensors **15** suggest the existence of presence or activity in that space that when combined with the logic in their respective platforms result in one or more of the platforms initiating a command to change the state of the power management system **32** to allow for at least some electricity to reach to loads attached to the electrical lighting circuit **28**. In some instances the command issued by one or more of these platforms may be to allow more electricity into the circuit or to allow less electricity. In all instances,

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these commands are assessed by the central light decision engine **66** and executed or not based on the determination of that one or more platforms.

In one embodiment, the switch terminal **12** or equivalent, while observing a three dimensional space, may have one or more local installed platforms determine that their local interpretation of the signals collected via one or more sensors **15** suggest the absence of presence or activity in that space that when combined with the logic in their respective platforms result in one or more of the platforms initiating a command to change the state of the power management system **32** to allow for no electricity to reach to loads attached to the electrical circuit **28**. In some instances the command issued by one or more of these platforms may be first allow more or less electricity into the circuit but it ultimately request that not electricity be allowed to power loads. In all instances, these commands are assessed by the central light decision engine **66** and executed or not based on the determination of that one or more platforms, as illustrated in FIG. **6**.

In one embodiment, when it includes an ambient light sensing device **18** as one of its sensors **15**, the switch terminal **12** or equivalent can assess the illuminance of the three dimensional space or building **25** it observes. In certain cases, the local installed platforms, can interpret the signal from this ambient light sensing device **18** and use that measurement to alter the switch terminal **12** or equivalent operation. Local installed platforms can use the ambient light measurement to trigger certain actions within their own platform or initiate other local installed platforms. These one or more platforms **14** can also issue commands to change the power management system's **32** state that instructs that system **10** to change its control of the electrical lighting circuit **14** until a specific value is attained from the attached ambient light sensing device.

In one embodiment, when it includes an ambient light sensing device **18** as one of its sensors **15**, the switch terminal **12** or equivalent can employ any system **10** local platforms for determining whether there is an existence or absence of presence or activity of a building occupant and the nature of that circumstances combined with an ambient light sensor to maintain a state of constant lighting level in a space (constant illuminance), or at least attempt to reach a state closest to the desired levels by assessing changes in ambient light conditions via a sensor **15**, interpreting those changes via one or more platforms and then adjusting the state of the power management system **32** to vary the amount of power reaching the electrical lighting loads. The platform maintaining the constant illuminance provided by the switch terminal **12** or equivalent may attempt to maintain the exact amount of light originally created, or it might navigate to other lighting levels based on certain instructions from other platforms executing on the device **18**.

In one embodiment, when it includes an ambient light sensing device **18** as one of its sensors **15**, the switch terminal **12** or equivalent can receive inputs from a building occupant via an interface **20**, an application on a mobile device **23** or a platform initiated on a first or third party cloud service to request a certain level of illuminance from the electrical circuit **28** and electrical lighting loads connected to that switch terminal **12** or equivalent. Once this manual request is received by a switch terminal **12** or equivalent, it can maintain a level of constant illuminance, or at least attempt to reach a state closets to the desired levels by assessing changes in ambient light conditions via a sensor **15**, interpreting those changes via one or more platforms and then adjusting the state of the power management system **32**

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to vary the amount of power reaching the electrical lighting loads. The platform maintaining the constant illuminance provided by the switch terminal **12** or equivalent when the light level is manually requested by a building occupant will control the state of the power management system **32** in its attempt to reflect the requested value until a local installed platform decides for it to no longer be controlling.

In one embodiment, the local installed platforms can combine with the power management system **32** to shift the level of power reaching the electrical lighting loads. When these shifts occur, the local installed platforms can execute a fully platform able (not fixed) transition between one lighting levels to another. These transitions allow for an appreciably smooth transition of the lights that is non-linear like existing systems. In addition, the fully platform able nature of these transitions allow for the local installed platforms, if desired, to use the transition to communicate certain messages to the occupants of a room.

In one embodiment, one or more of the local installed platforms can serve to regulate the power management system **32** according to the platforms' internally defined logic and thus control the state of the electrical lighting circuit **14** in order to effectuate a modulation of the light exposure generated by the electrical lighting loads attached to that circuit in order to create health related impacts on the occupants of a space within which those loads exist. These health related impacts could result from the specific exposure to light or lack of exposure to light or exposure to different levels of light at different times of the day, or in patterns that affect a human subjects biological systems.

As illustrated in FIG. 7, in one embodiment, the present invention includes a switch terminal **12** or equivalent that minimally includes two or more switch terminal **12** or equivalent to operate on a commonly accessible network **74** and thus can coordinate their individual and concerted operation based on information shared between the devices. This interaction also allows for the switch terminal **12** or equivalent to execute additional capabilities as an integrated system that an individual switch terminal **12** or equivalent could not do in isolation.

In one embodiment, two or more switch terminal **12** or equivalent can match independently and use networking technology **68** shared in common by each device **18** to create an ad-hoc mesh network **64** between themselves, thus forming the required commonly accessible network **74** to allow the independent devices to begin constituting the switch terminal **12** or equivalent. In this embodiment, no externally provided network (third party) like a wireless LAN, hard-wire or bridge **18** is necessary for the system **10** to compose itself.

In one embodiment, the two or more switch terminals **12** or equivalent can use backend **17**, cloud system **21** and the like to seek and identify the existence of other switch terminal **12** or equivalent on the network and begin constituting the switch terminal **12** or equivalent.

In one embodiment two or more switch terminals **12** or equivalents use a previously existing and independent third party accessible network **10** to seek and identify the existence of other switch terminals **12** or equivalent at first party system **10**, or at third party system **10**. This can then begin constituting the switch terminal **12** or equivalent as well as interact with other nodes that might exist on that same system **10**. If this system **10** has other third party devices **18** associated with it then both the switch terminal **12** or equivalent and an individual switch terminal **12** or equivalent can interact with those available devices **18**. In one embodiment if this network has access to Network Systems

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25. This interaction can then be coupled with first party back-end, cloud **21**, third party devices **18** or services, and the like.

In one embodiment, the switch terminal **12** or equivalent can allow other switch devices of system **10**, or a third party system to begin sending and receiving data between devices to allow for the operation of those individual switch terminal **12** or equivalent to be based on data that they wouldn't have been able to attain independently via their local installed platforms, sensors **15**, interfaces **20** and the like.

In one embodiment, the switch terminal **12** or equivalent can use the individual switch terminal **12** or equivalents' ability to combine signals from the sensor or sensors **15** with local installed platforms and make determinations as to the existence or absence of presence or activity in that space, and determine the nature or characteristics of the presence or activity in that space to inform the members of the switch terminal **12** or equivalent to the existence or absence of presence or activity in the disparately observed spaces and the nature or characteristics of the presence of activity as to allow the members of the system to alter their operation based on information collected from spaces they cannot similarly observe based on their physical location.

In one embodiment, a switch terminal **12** or equivalent ("first device") that is a member of a switch terminal **12** or equivalent can utilize another member's ("second device") ability to scan an three dimensional space that is not similarly perceived from the first device **18** and determine the existence or absence of presence of activity in that space to allow the first device **18** to decide how to control an electrical lighting circuit **14** to which it is attached. The dimensions of how the first device **18** controls the electrical lighting circuit **28** can thus be a result of its interpretation of a multitude of signals and other contextual factors received from a second device **18** to create an adaptive control system experience, that as a non-limiting example, provides for the, local determination of lighting states. The adaptive control system is based on what is specifically happening in one or more three dimensional spaces of building **25** not similarly observed by a particular switch terminal **12** or equivalent.

In one embodiment, a switch terminal **12** or equivalent ("first device") that is a member of a switch terminal **12** or equivalent may have more than one local installed platforms executing simultaneously on its integrated computing device **14** that each are independently assessing a single signal from a sensor **15** or a multitude of signals from more than one sensor **15** attached to a other members of the switch terminal **12** or equivalent ("other devices") so as to allow the one or more platforms on the first device **18** to make their own independent decision about how the lighting environment as controlled by the electrical lighting circuit **14** to which that first switch terminal **12** or equivalent is attached should adapt to meet a predetermined state based on the one or more platforms' independent assessments as to the existence or absence of presence or activity in a space or the nature of the existence or absence of presence or activity in a space not perceived in the same way by the first device.

In one embodiment, a switch terminal **12** or equivalent ("first device") observes a three dimensional space of building **25** and receives information from other devices **18** or platforms elements of the system **10**, as well as third party systems, switch terminal **12** or equivalent ("other devices"), may receive data from other devices that allow one or more local installed platforms on the first device **18** to determine based on its local interpretation of the signals collected via one or more sensors **15** of other devices, or a direct indication from a local installed platforms on those other devices

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that based on their local interpretation of their collected signals that there is the existence of presence or activity in their observed space—a space not similarly observed by the first device. The reaching of this independent determination or the reception of a similar message from another device **18** can allow the first device **18** to inform it's local installed platforms to evaluate whether the first device **18** may also initiate a command to change the state of the power management system **32** to allow for at least some electricity to reach to loads attached to the electrical lighting circuit **28**.

In one embodiment the command issued by one or more of these platforms may be to allow more electricity into the circuit or to allow less electricity. In all instances, these commands are assessed by a central lighting decision engine and executed or not based on the determination of that one or more platforms.

In one embodiment, a switch terminal **12** or equivalent (“first device”) that is a member of a switch terminal **12** or equivalent, while observing a three dimensional space and receiving information from other members of the switch terminal **12** or equivalent (“other devices”), to determine based on its local interpretation of the signals collected via one or more sensors **15** of other devices, or a direct indication from a local installed platforms on those other devices that based on their local interpretation of their collected signals that there is the absence of presence or activity in the observed space—a space not similarly observed by the first device. The reaching of this independent determination or the reception of a similar message from another device **18** can allow the first device **18** to inform it's local installed platforms to evaluate whether the first device **18** may initiate a command to change the state of the power management system **32** to allow for no electricity to reach to loads attached to the electrical lighting circuit **14**.

In one embodiment the command issued by one or more of these platforms may first allow more or less electricity into the circuit but it ultimately request that no electricity be allowed to power loads at all. In all instances, these commands are assessed by the central light decision engine **66** and executed or not based on the determination of that one or more platforms.

In one embodiment, when at least one of the switch terminal **12** or equivalent that is a member of a switch terminal **12** or equivalent includes an ambient light sensing device **18** as one of its sensors **15**, the system can assess the illuminance in three dimensional spaces where at times not all of the switch terminal **12** or equivalent can perceive the illuminance of all the observed spaces in a building. In certain cases, the local installed platforms on one device **18** (“first device”), can interpret the illuminance signal from an ambient light sensing device **18** attached to a second device **18** and use that measurement to alter the first devices' operation. Local installed platforms on any switch terminal **12** or equivalent connected to a switch terminal **12** or equivalent can use the ambient light measurement capability of any other member of the system to trigger certain actions within its own platform or initiate other local installed platforms on other devices.

These one or more platforms can also issue commands to change the power management system's **32** state for the first device, or possibly to other devices in the system by instructing that the system to change its control of the electrical lighting circuit **14** until a specific value is attained from a single or plurality of ambient light sensing devices attached to the system **10**.

In one embodiment, when at least one of the switch terminal **12** or equivalent that is a member of a switch

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terminal **12** or equivalent includes an ambient light sensing device **18** as one of its sensors **15**, the system can to assess the illuminance in three dimensional spaces where at times not all of the switch terminal **12** or equivalent can perceive the illuminance of all the observed spaces. In some cases, the switch terminal **12** system or equivalent can combine is ability to make determinations as to the existence or absence of presence in activity and the nature of those circumstances across one or more spaces observed by at least one of its members and the capability of one or more of those devices via at least one ambient light sensor to assess the illuminance of one or more of the observed spaces to maintain a state of constant lighting level in one or more spaces (constant luminance), or at least attempt to reach a state closest to the desired levels of illuminance by assessing changes in ambient light conditions via a sensor **15**, interpreting those changes via one or more platforms on at least one of the member devices and then adjusting the state of the power management system **32** on one or more of the member devices to vary the amount of power reaching the electrical loads.

The platform or platforms maintaining the constant illuminance provided by the switch terminal **12** or equivalent may attempt to maintain the exact amount of light originally desired, or it might navigate to other lighting levels based on certain instructions from other platforms executing on devices within the system.

In one embodiment, when at least one of the switch terminal **12** or equivalent that is a member of a switch terminal **12** or equivalent includes an ambient light sensing device **18** as one of its sensors **15**, the system can to assess the illuminance in three dimensional spaces where at times not all of the switch terminal **12** or equivalent can perceive the illuminance of all the observed spaces. In some cases, the switch terminal **12** or equivalent can receive inputs from a building occupant via an interface **20** coupled to a switch terminal **12** or equivalent that is a member of the system, an application on a mobile device **23** or a platform initiated on a first or third party cloud service to request a certain level of illuminance from one or more of the electrical circuit **28** and electrical lighting loads connected to switch terminal **12** or equivalent that are a member of the system **10**.

Once this manual request is received by a switch terminal **12** or equivalent that is a member of system **10** it can distribute that command to any one or multitude of other devices on the system, and if requested, maintain a level of constant illuminance in the spaces observed by one or more of the member devices, or at least attempt to reach a state closest to the desired levels by assessing changes in ambient light conditions via a one or more ambient light sensors **15** included in member devices, by interpreting changes in ambient light collected via one or more member devices, including the possibility of collecting readings from its own sensors **15**, via one or more platforms and then adjusting or requesting the adjustment of the state of the power management system **32** on any number of the member devices in order to vary the amount of power reaching the electrical lighting loads.

The platform or platforms maintaining the constant illuminance provided by the switch terminal **12** or equivalent when the light level is manually requested by a building occupant will control the state of the power management system **32** of member devices in its attempt to reflect the requested illuminance level until a local installed platform on any one of the member devices decides for it to no longer be controlling.

In one embodiment, when two or more switch terminal **12** or equivalent are members of a single switch terminal **12** or equivalent, the local installed platforms on each discrete member device **18** can interact with local installed platforms of other member devices to orchestrate system wide changes in lighting levels by coordinating individual shifts in the level of power reaching the electrical loads attached to member devices. When these shifts occur, the local installed platforms can execute a fully platform able (not fixed) transition between one lighting level to another by both a single switch terminal **12** or equivalent in the system or by two or more, and possible the entire group of member devices. In addition, the fully platform able nature of these transitions allow for the local installed platforms, if desired, to use the transition to communicate certain messages to the occupants of a room or any other space in building **25**.

In one embodiment, when two or more switch terminal **12** or equivalent are members of a single switch terminal **12** or equivalent, one or more of the local installed platforms on each discrete member device **18** can interact with local installed platforms of other member devices their power management systems **32** according to the platforms' internally defined logic and thus control the state of the electrical lighting circuits **14** attached to the lighting system to effectuate a modulation of the light exposure generated by the electrical lighting loads attached to those circuits in order to create health related impacts on the occupants of a space or spaces where those loads exist. These health related impacts could result from the specific exposure to light or lack of exposure to light or exposure to different levels of light at different times of the day, or in patterns that affect a human subject's biological systems.

In one embodiment system switch **12** can be used for local machine learning on switch **12** and one or more devices **18** can be combined for this purpose.

In one embodiment, when a single switch terminal **12** or equivalent is the sole member of a switch terminal **12** or equivalent, one or more of the local installed platforms on that device **18** can collect and optionally summarize data received from sensors **15** integrated into that device, the data generated by a building occupant's interaction with the switch terminal **12** or equivalent via interfaces **20**, mobile devices **23**, and data created by local installed platforms to create a corpus of data upon which those local installed platforms can analyze and derive insights through the use of platform algorithms that improve the local installed platforms accuracy in determining the presence of activity in an observed space, the absence of activity in an observed space, the characteristics of the activity and the most appropriate adaptive control system behavior as learned from the collected data. As a non-limiting example of a type of control system behavior, the system **10** can identify based on the learned data the desired level of illuminance in a space based on the observed level of activity, the appropriate amount of electricity required by the electrical lighting circuit **14** to produce the desired amount of illuminance in the observed space as prescribed by one or more of the local installed platform **39**, thus resulting in the continual enhancement of the switch terminal **12** or equivalent performance in delivering the adaptive control system in a space observed by the switch terminal **12** or equivalent.

In one embodiment, when one or more switch terminal **12** or equivalent are members of a single switch terminal **12** or equivalent that is not connected to a Network Systems **25** connection, one or more of the local installed platforms on one or more of the discrete member devices **18** can collect and optionally summarize data received from sensors **15**

integrated on one or any number of the member devices **18**, data generated by a building occupants interaction with the switch terminal **12** or equivalent via interfaces **20** on one or any number of the first party devices **18**, other similar first party devices **18**, mobile devices **23**. Network Systems **25** devices **18**, third party devices **18** or services accessible directly via Network Systems **25**, and data created by local installed platforms on one or more of the member devices in the switch terminal **12** or equivalent to create a corpus of data upon which the local installed platforms on any one of the member devices can analyze and derive insights through the use of platforms algorithms that improve the local installed platforms accuracy in determining the presence of activity in an observed space, the absence of activity in an observed space, the characteristics of the activity and the most appropriate adaptive control system behavior as learned from the collected data. As a non-limiting example of a type of control system behavior, the system **10** can identify based on the learned data the desired level of illuminance in an observed space based on the observed level of activity, the appropriate amount of electricity required by the electrical lighting circuit **14** to produce the desired amount of illuminance in any particular space as prescribed by one or more of the local installed platform **39**, thus resulting in the continual enhancement of switch terminal **12** or equivalent performance in delivering the adaptive control system in a space observed by any member of the switch terminal **12** or equivalent.

In one embodiment, when one or more switch terminal **12** or equivalent are members of a single switch terminal **12** or equivalent and that system is connected to the Network Systems **25**, one or more of the local installed platforms on one or more of the discrete member devices can collect and optionally summarize data received from sensors **15** integrated on one or any number of the member devices, data generated by a building occupants interaction with the switch terminal **12** or equivalent via interfaces **20** on one or any number of the first party devices **18**, mobile devices **23**, Network Systems devices **18**, third party devices **18** or services directly via a Network Systems **25** and data created by local installed platforms on one or more of the first or third party devices **18** to create a corpus of data upon which those installed platforms can analyze and derive insights through the use of platforms algorithms that improve the local installed platforms accuracy in determining the presence of a building occupant, a building occupant's activity in an observed space, the absence of a building occupant or an activity in an observed space the characteristics of the activity and the most appropriate adaptive control system behavior as learned from the collected data. As a non-limiting example of a type of control system behavior, the system **10** can identify based on the learned data the desired level of illuminance in a space based on the observed level of activity, the appropriate amount of electricity required by a electrical lighting circuit **28** to produce the desired amount of illuminance in a space as prescribed by one or more of the local installed platforms.

In one embodiment this can result in the continual enhancement of switch terminal **12** or equivalent performances in delivering the adaptive control system in a space observed by any member of the switch terminal **12** or equivalent.

In one embodiment, when a single switch terminal **12** or equivalent includes an ambient light sensor **15**, the local installed platforms on the specific switch terminal **12** to which the ambient light sensor **15** is integrated, or if that switch terminal **12** or equivalent is a member of a switch

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terminal 12 or equivalent than the local installed platforms on any of the devices 15 in that system 10 can collect and optionally summarize illuminance data from the ambient light sensor 15 on the original device 18, data created by locally installed platforms on any device 18 in the system 10 that relate to the state of the power provided to the electrical lighting circuits 38 controlled by those devices 18, the load characteristics of lighting loads attached to any circuit attached to a member of the system 10 to be analyzed by a platform intended to generate a mathematical relationship between the light levels perceived by the ambient light sensor on the original device 18 and the actual levels of light present in the space observed by the original device 18.

Additionally, this same data and computational results can be used to inform local installed platforms on any member of the switch system of the actual lighting characteristics, including how much power relates to the creation of how much light projected into the space is represented by any electrical lighting circuit 38 connected to a switch terminal 12 or equivalent that is a member of the switch terminal 12 or equivalent.

In one embodiment, when a single switch terminal 12 or equivalent is the sole member of a switch terminal 12 or equivalent, one or more of the local installed platforms on that device 18 can collect and optionally summarize data received from sensors 15 integrated into that device 18, data generated by a building occupant's interaction with the switch terminal 12 or equivalent via interfaces 20, mobile devices 23, and data created by local installed platforms to create a corpus of data upon which those local installed platforms can analyze and derive insights through the use of platforms algorithms that improve the local installed platforms accuracy in determining the relationship between an occupant's or occupants' activity in a specific space and their desired level of illumination in that space for a particular activity. The local installed platforms responsible for computing this relationship will take into consideration the evolving nature of activity in an observed space, the building occupant's manual inputs to interfaces 20 and mobile devices 23 to adjust the level of illuminance in a space during any particular activity and continually improve the accuracy of the switch terminal 12 or equivalent ability to make the appropriate recommendations for illuminance relative to the occupant's or occupants' activity, thus resulting in the continual enhancement of the switch terminal 12 or equivalent performance in delivering the adaptive control system experience in a space observed by the switch terminal 12 or equivalent.

In one embodiment, when one or more switch terminal 12 or equivalent are members of a single switch terminal 12 or equivalent, that is not connected to a Network Systems 25 connection One or more of the local installed platforms on one or more of the discrete member devices can collect and optionally summarize data received from sensors 15 integrated on one or any number of the member devices 18. Additionally data generated can be provided by a building occupant's interaction with the switch terminal 12 or equivalent which can be via interfaces 20 on one or any number of the member devices 18, other similar first party devices 18, mobile devices 23, and Network Systems devices 18, third party devices 18 or services and services. Additionally data created by local installed platforms on one or more of the member devices in the switch terminal 12 or equivalent create a corpus of data upon which the local installed platforms on any one of the member devices that can analyze and derive insights through the use of platforms algorithms that improve the local installed platforms accuracy in deter-

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mining the relationship between an occupant's or occupants' activity in a specific space and their desired level of illumination in that space for a particular activity.

In one embodiment the local installed platforms responsible for computing this relationship can take into consideration the evolving nature of activity in an observed space, the building occupant's manual inputs to interfaces 20 and mobile devices 23 to adjust the level of illuminance in a space during any particular activity and continually improve the accuracy of the switch terminal 12 or equivalent ability to make the appropriate recommendations for illuminance relative to the occupant's or occupants' activity. This can result in the continual enhancement of switch terminal 12 or equivalent performances in delivering the adaptive control system experience in a space observed by any member of the switch terminal 12 or equivalent.

In one embodiment, when one or more switch terminal 12 or equivalent are members of a single switch terminal 12 or equivalent and system 10 is connected to Network Systems 25 one or more of the local installed platforms on one or more of the discrete member devices can collect and optionally summarize data received from sensors 15 integrated on one or any number of the member devices, data generated by a building occupants interaction with the switch terminal 12 or equivalent via interfaces 20 on one or any number of the member devices, other similar first party devices 14, mobile devices 23. Network Systems 25 devices 18, third party devices 18 or services accessible directly via a Network Systems 25, third party control cloud service 17, third party devices 18 and services accessible via Network Systems 25 connection and data created by local installed platforms on one or more of the network 10 or third party devices 18 to create a corpus of data upon which those local installed platforms can analyze and derive insights through the use of platforms algorithms that improve the local installed platforms accuracy in determining the relationship between an occupant's or occupants' activity in a specific space and their desired level of illumination in that space for a particular activity.

In one embodiment local installed platforms responsible for computing this relationship can take into consideration the evolving nature of activity in an observed space, the building occupant's manual inputs to interfaces 20 and mobile devices 23 to adjust the level of illuminance in a space during any particular activity and continually improve the accuracy of the switch terminal 12 or equivalent ability to make the appropriate recommendations for illuminance relative to the occupant's or occupants' activity, thus resulting in the continual enhancement of switch terminal 12 or equivalent performance in delivering the adaptive control system in a space observed by any member of the switch terminal 12 or equivalent.

In one embodiment, when one or more switch terminal 12 or equivalent are members of a single switch terminal 12 or equivalent that is not connected to an Network Systems 25 connection, one or more of the local installed platforms on one or more of the discrete member devices can collect and optionally summarize data received from sensors 15 integrated on one or any number of the member devices, data generated by a building occupants interaction with the switch terminal 12 or equivalent via interfaces 20 on one or any number of the member devices, other similar first party devices 14, mobile devices 23, third party devices 18, and data created by local installed platforms on one or more of the devices 18 in the switch terminal 12 or equivalent to create a corpus of data upon which the local installed platforms on any one of the member devices can analyze and

derive insights through the use of platforms algorithms that improve the local installed platforms accuracy in determining the relationship between an occupant's or occupants' movement from one space to another within large space that is made up of two or more smaller but related spaces.

By analyzing aspects of this data set, including, but not limited to, time of day, time intervals between sensor data, activity levels, presence or absence of presence, the local installed platforms can construct activity or pattern maps that represent the distinctive manner by which occupants observed in these spaces move between them. This information can then be used by local installed platforms 34 distributed throughout the switch terminal 12 or equivalent to predicatively change the state of adaptive control systems, including but not limited to the electrical lighting circuits 14 controlled by their respective switch terminal 12 or equivalent to allow for light to be adjusted in an particular space in advance of the occupant's or occupants' presence in that space or just before that light is needed by an occupant or occupants. The local installed platforms responsible for computing these relationship and maps will take into consideration the evolving nature of activity in an observed space, the building occupant's manual inputs to interfaces 20 and mobile devices 23 to adjust the level of illuminance in a space during any particular activity and continually improve the accuracy of the switch terminal 12 or equivalent ability to make the appropriate recommendations for machine learning illuminance relative to the occupant's or occupants' activity. This can result in the continual enhancement of switch terminal 12 or equivalent performances in delivering the adaptive control system experience in a space observed by any member of the switch terminal 12 or equivalent.

In one embodiment, when one or more switch terminal 12 or equivalent are members of a single switch terminal 12 or equivalent and that system is connected to the Network Systems 25, one or more of the local installed platforms on one or more of the discrete member devices can collect and optionally summarize data received from sensors 15 integrated on one or any number of the member devices, data generated by a building occupants interaction with the switch terminal 12 or equivalent via interfaces 20 on one or any number of the member devices, other similar first party devices 14, mobile devices 23, Network Systems devices 18, third party devices 18 and services accessible directly via Network Systems 25, third party control cloud services 22, third party devices 18 and services accessible via the network and Network Systems 25 connection and data created by local installed platforms on one or more of the member devices to create a corpus of data upon which those local installed platforms can analyze and derive insights through the use of platforms algorithms that improve the local installed platforms accuracy in determining the relationship between an occupant's or occupants' movement from one space to another within large space that is made up of two or more smaller but related spaces. By analyzing aspects of this data set, including, but not limited to, time of day, time intervals between sensor data, activity levels, presence or absence of presence, the local installed platforms can construct activity or pattern maps that represent the distinctive manner by which occupants observed in these spaces move between them.

This information can then be used by local installed platforms 34 distributed throughout the switch terminal 12 or equivalent to predicatively change the state of adaptive control systems, including but not limited to the electrical lighting circuits 14 controlled by their respective switch

terminal 12 or equivalent to allow for light to be adjusted in an particular space in advance of the occupant's or occupants' presence in that space or just before that light is needed by an occupant or occupants. The local installed platforms responsible for computing these relationship and maps will take into consideration the evolving nature of activity in an observed space, the building occupant's manual inputs to interfaces 20 and mobile devices 23 to adjust the level of illuminance in a space during any particular activity and continually improve the accuracy of the switch terminal 12 or equivalent ability to make the appropriate recommendations for machine learning illuminance relative to the occupant's or occupants' activity, thus resulting in the continual enhancement of switch terminal 12 or equivalent performance in delivering the adaptive control system in a space observed by any member of the switch terminal 12 or equivalent.

In one embodiment, when a single switch terminal 12 or equivalent is the sole member of a switch terminal 12 or equivalent, one or more of the local installed platforms on that device 18 can collect and optionally summarize data received from sensors 15 integrated into that device, data generated by a building occupant's interaction with the switch terminal 12 or equivalent via interfaces 20, mobile devices 23, and data created by local installed platforms to create a corpus of data upon which those local installed platforms can analyze and derive insights through the use of platforms algorithms that improve the local installed platforms accuracy in determining the identity of an occupant or occupants observed in a space.

As the accuracy of the one or more platforms ability to identify distinct people regularly perceived in a given observed space increase, these local installed platforms can then construct personas containing profile information about such occupants that include, among other information, the occupants desired lighting preferences for a particular space given a particular activity and time of day, and the regular movement patterns within a series of connected spaces for that occupant. Subsequently these personas can be used to further improve the accuracy of other predictions made by the local installed platforms to enhance the switch terminal 12 or equivalent ability to make the appropriate recommendations for changes in the state of adaptive control systems, including but not limited to the illuminance relative to the specific occupant's or occupant's activity.

The local installed platforms responsible for computing this relationship can take into consideration the evolving nature of activity in an observed space, the identified building occupant's manual inputs to interfaces 20 and mobile devices 23 to adjust the level of illuminance in a space during any particular activity and continually improve the accuracy of the switch terminal 12 or equivalent recommendations. In one embodiment this can result in the continual enhancement of the switch terminal 12 or equivalent performances in delivering the adaptive control system experience in a space observed by the switch terminal 12 or equivalent.

In one embodiment, when one or more switch terminal 12 or equivalent are members of a single switch terminal 12 or equivalent that is not connected to an Network Systems 25 connection, one or more of the local installed platforms on one or more of the discrete member devices can collect and optionally summarize data received from sensors 15 integrated on one or any number of the member devices, data generated by a building occupants interaction with the switch terminal 12 or equivalent via interfaces 20 on one or any number of the member devices, other similar first party

devices **18**, mobile devices **23**, third party devices **18**, and data created by local installed platforms on one or more of the member devices in the switch terminal **12** or equivalent to create a corpus of data upon which the local installed platforms on any one of the member devices can analyze and derive insights through the use of platforms algorithms that improve the local installed platforms accuracy in determining the identity of an occupant or occupants observed in a space.

As the accuracy of the one or more platforms can provide an ability to identify distinct people regularly perceived in a given observed space increase, these local installed platforms can then construct personas containing profile information about such occupants that include, among other information, the occupants desired lighting preferences for a particular space given a particular activity and time of day, and the regular movement patterns within a series of connected spaces for that occupant. Subsequently these personas can be used to further improve the accuracy of other predictions made by the local installed platforms to enhance the switch terminal **12** or equivalent ability to make the appropriate recommendations for changes of state of adaptive control systems, including but not limited to the illuminance relative to the specific occupant's or occupants' activity.

In one embodiment the local installed platforms responsible for computing this relationship can take into consideration the evolving nature of activity in an observed space, the identified building occupant's manual inputs to interfaces **20** and mobile devices **23** to adjust the level of illuminance in a space during any particular activity and continually improve the accuracy of the switch terminal **12** or equivalent's recommendations **72**. This can result in the continual enhancement of switch terminal **12** or equivalent performances in delivering the adaptive control system experience in a space observed by any member of the switch terminal **12** or equivalent.

In one embodiment, when one or more switch terminal **12** or equivalent are members of a single switch terminal **12** or equivalent and that system is connected to the Network Systems **25**, one or more of the local installed platforms on one or more of the discrete member devices can collect and optionally summarize data received from sensors **15** integrated on one or any number of the member devices, data generated by a building occupants interaction with the switch terminal **12** or equivalent via interfaces **20** on one or any number of the member devices, other similar first party devices **18**, mobile devices **23**, Network Systems **25** devices **18**, third party devices **18** and services accessible directly via Network Systems **25**, third party control cloud services, third party devices **18** and services accessible via the network and Network Systems **25** connection and data created by local installed platforms on one or more of the devices **18** or first or third parties to create a corpus of data upon which those local installed platforms can analyze and derive insights through the use of platforms algorithms that improve the local installed platforms accuracy in determining the identity of an occupant or occupants observed in a space. As the accuracy of the one or more platforms ability to identify distinct people regularly perceived in a given observed space increases, these local installed platforms can then construct personas containing profile information about such occupants that include, among other information, the occupants desired lighting preferences for a particular space given a particular activity and time of day, and the regular movement patterns within a series of connected spaces for that occupant. Subsequently these perso-

nas can be used to further improve the accuracy of other predictions made by the local installed platforms to enhance the switch terminal **12** or equivalent ability to make the appropriate recommendations for changes of state of adaptive control systems, including but not limited to the illuminance relative to the specific occupant's or occupants' activity.

In one embodiment the local installed platforms responsible for computing this relationship can include the evolving nature of activity in an observed space, the identified building occupant's manual inputs to interfaces **20** and mobile devices **23** to adjust the level of illuminance in a space during any particular activity and continually improve the accuracy of the switch terminal **12** or equivalent's recommendations **72**. In one embodiment this can result in the continual enhancement of switch terminal **12** or equivalent performances in delivering the adaptive control system in a space observed by any member of the switch terminal **12** or equivalent.

In one embodiment, when two or more switch terminal **12** or equivalent are members of a single switch terminal **12** or equivalent that is not connected to an Network Systems **25** connection, one or more of the local installed platforms on one or more of the discrete member devices can collect and optionally summarize data received from sensors **15** integrated on one or any number of the member devices, data generated by a building occupants interaction with the switch terminal **12** or equivalent via interfaces **20** on one or any number of the member devices, other similar first party devices **18**, mobile devices **23**, third party devices **18**, and data created by local installed platforms on one or more of the member devices in switch terminal **12** or equivalent to create a corpus of data upon which the local installed platforms on any one of first or third party devices **18** can analyze and derive insights through the use of platforms algorithms that improve the local installed platforms accuracy in determining the spatial relationships of one observed space to other observed spaces within the same switch terminal **12** or equivalent. By assessing facets of the data, including but not limited to, intervals between recorded sensor data, building occupant interactions with interfaces, the movement of occupants, the local installed platforms can then construct two and optional three dimensional maps of the spaces observed by the switch terminal **12** or equivalent. The local installed platforms responsible for computing these space relationship will take into consideration the evolving composition of the switch **12** or system include the addition or removal of switch terminal **12** or equivalent, the nature of activity in the observed spaces, the identified building occupant's manual inputs to interfaces **20** and mobile devices **23** to adjust the state of adaptive control systems, including but not limited to the level of illuminance in a space during any particular activity and continually improve the accuracy of the switch terminal **12** or equivalent spatial mapping. As a non-limiting example this spatial map can be used by other local installed platforms to enhance the adaptive control system experience provided by the switch terminal **12** or equivalent.

In one embodiment, when one or more switch terminals **12** or equivalents are members of a single switch terminal **12** or equivalent and that system **10** is connected to the Network Systems **25**. One or more of the local installed platforms on one or more of the devices **18** can collect and optionally summarize data received from sensors **15** integrated on one or any number of first party devices **18**, data generated by a building occupant interaction with the switch terminal **12** or equivalent via interfaces **20** on one or any number of the

member devices, other similar first party devices **18**, mobile devices **23**. Network Systems devices **18**, and third party devices **18**. This can create a corpus of data upon which those local installed platforms can analyze and derive insights through the use of platform algorithms that improve the local installed platforms accuracy in determining the spatial relationships of one observed space to other observed spaces within the same switch terminal **12** or equivalent.

By assessing facets of the data, including but not limited to, intervals between recorded sensor data, building occupant interactions with interfaces, the movement of occupants, the local installed platforms can then construct two and optional three dimensional maps of the spaces observed by the switch terminal **12** or equivalent. The local installed platforms responsible for computing these space relationship will take into consideration the evolving composition of the switch system **72** include the addition or removal of switch terminal **12** or equivalent, the nature of activity in the observed spaces, the identified building occupant's manual inputs to interfaces **20** and mobile devices **23** to adjust the state of adaptive control systems, including but not limited to the level of illuminance in a space during any particular activity and continually improve the accuracy of the switch terminal **12** or equivalent spatial mapping.

In one embodiment this spatial map is used by other local installed platforms to enhance the adaptive control system experience provided by the switch terminal **12** or equivalent.

In one embodiment switch terminal **12** or equivalent or equivalent can provide remote learning on a cloud.

In one embodiment system terminal or equivalent can be used for illuminance levels.

In one embodiment, when a single switch terminal **12** or equivalent includes an ambient light sensor **15** and is connected to Network Systems **25** via networking technologies **25** on the same device **18** or if that switch terminal **12** or equivalent is a member of a switch terminal **12** or equivalent, then can alternatively be connected to the Internet via networking technologies, such as Network System on other devices **18** in the system **10**, the local installed platforms **65** on the specific switch terminal **12** or equivalent to which the ambient light sensor is integrated, or if that switch terminal **12** or equivalent is a member of a switch terminal **12** or equivalent than the local installed platforms on any of the devices in that system can collect and optionally summarize illuminance data from the ambient light sensor on the original device, data created by locally installed platforms on any device **18** in the system that relate to the state of the power provided to the electrical lighting circuits **14** controlled by those devices, the load characteristics of lighting loads attached to any circuit attached to system **10** element which is then transferred to a remote server to be analyzed by a platform running on that remote machine or device **18** intended to generate a mathematical relationship between the light levels perceived by the ambient light sensor **16** on the original device **18** and the actual levels of light present in the space observed by the original device.

Additionally, this same data and computational results can be used to inform local installed platforms on any member of the switch system of the actual lighting characteristics, including how much power relates to the creation of how much light projected into the space is represented by any electrical lighting circuit connected to a switch terminal **12** or equivalent that is a member of the switch terminal **12** or equivalent. After the computation of these new results has been completed on the remote server, these results are then transferred back to the originating switch device **18** via its own Network Systems **25** connection, or if present via the

Network Systems **25** connection of another switch terminal **12** or equivalent that is a member of the same switch terminal **12** or equivalent.

In one embodiment switch terminal **12** or equivalent or equivalent can be used for lighting preferences.

In one embodiment, when a single switch terminal **12** or equivalent is the sole member of a switch terminal **12** or equivalent and that devices connected to Network Systems **25** via networking technologies **68** on the same device, one or more of the local installed platforms on that device **18** can collect and optionally summarize data received from sensors **15** integrated into that device, data generated by a building occupant's interaction with the switch terminal **12** or equivalent system **10** via interfaces **20**, mobile devices **23**, and data created by local installed platforms to create a corpus of data which is then transferred to a remote server where platforms running on a remote machine can analyze and derive insights through the use of platforms algorithms that improve the local installed platforms accuracy in determining the relationship between an occupant's or occupant's activity in a specific space and their desired the state of adaptive control systems, including but not limited to the level of illumination in that space for a particular activity.

In one embodiment the remote platforms responsible for computing this relationship can include the evolving nature of activity in an observed space, the building occupant's manual inputs to interfaces **20** and mobile devices **23** to adjust the level of illuminance in a space during any particular activity and continually improve the accuracy of the switch terminal **12** or equivalent ability to make the appropriate recommendations for changes in the state of adaptive control systems, including but not limited to the illuminance relative to the occupant's or occupants' activity, thus resulting in the continual enhancement of the switch terminal **12** or equivalent performance in delivering the adaptive control system experience in apace observed by the switch terminal **12** or equivalent.

After the computation of these new results has been completed on the remote server, these results are then transferred back to the originating switch terminal **12** via its own Network Systems **25** connection, or if present via the Network Systems **25** connection of another switch terminal **12** or equivalent that is a member of the same switch terminal **12** or equivalent.

In one embodiment, when one or more switch terminal **12** or equivalent are members of a single switch terminal **12** or equivalent that connected to Network Systems **25** via networking technologies on the same device **18** or if that switch terminal **12** or equivalent is a member of a switch terminal **12** or equivalent, then can alternatively be connected to the Internet via Network System **25** on other devices **18** in the system **10**, one or more of the local installed platforms on one or more of the discrete member devices **18** can collect and optionally summarize data received from sensors **15** integrated on one or any number of the member devices, data generated by a building occupants interaction with the switch terminal **12** or equivalent via interfaces **20** on one or any number of the member devices, other similar first party devices **14**, mobile devices **23**, Network Systems **25**, devices **18**, backend **17**, cloud system **21** and services accessible directly via a Network Systems **25**, and data created by local installed platforms on one or more of the member devices in the switch terminal **12** or equivalent system **10** to create a corpus of data which is then transferred to a remote server where platforms running on a remote machine can analyze and derive insights through the use of platforms algorithms that improve the local installed platforms accuracy in deter-

mining the relationship between an occupant's or occupants' activity in a specific space and their desired state of adaptive control systems, including but not limited to the desired level of illumination in that space for a particular activity.

The remote platforms responsible for computing this relationship will take into consideration the evolving nature of activity in an observed space, the building occupant's manual inputs to interfaces **20** and mobile devices **23** to adjust the level of illuminance in a space during any particular activity and continually improve the accuracy of the switch terminal **12** or equivalent ability to make the appropriate recommendations for the state of adaptive control systems, including but not limited to the for illuminance relative to the occupant's or occupants' activity, thus resulting in the continual enhancement of switch terminal **12** or equivalent performance in delivering the adaptive control system experience in a space observed by any member of the switch terminal **12** or equivalent.

After the computation of these new results has been completed on the remote server, these results are then transferred back to the originating switch device **18** via its own Network Systems **25** connection, or if present via the Network Systems **25** connection of another switch terminal **12** or equivalent that is a member of the same switch terminal **12** or equivalent.

In one embodiment, when one or more switch terminal **12** or equivalent are members of a single switch terminal **12** or equivalent that is connected to Network Systems **25** via networking technologies **68** on the same device **18** or if that switch terminal **12** or equivalent is a member of a switch terminal **12** or equivalent, then can alternatively be connected to the Internet via Network System **25** on other member devices in the system, one or more of the local installed platforms on one or more of the discrete member devices can collect and optionally summarize data received from sensors **15** integrated on one or any number of the member devices, data generated by a building occupants interaction with the switch terminal **12** or equivalent via interfaces **20** on one or any number of the member devices, other similar first party devices **14**, mobile devices **23**, Network Systems **25** devices **18**, first party devices **18**, third party devices **18** or services and services accessible directly via a Network Systems **25**, create a corpus of data which is then transferred to a server where platforms running on a machine can analyze and derive insights through the use of platforms that improve the local installed platforms accuracy in determining the relationship between an occupant's or occupants' activity in a specific space and their desired state of adaptive control systems, including but not limited to the level of illumination in that space for a particular activity.

The remote platforms responsible for computing this relationship will take into consideration the evolving nature of activity in an observed space, the building occupant's manual inputs to interfaces **20** and mobile devices **23** to adjust the level of illuminance in a space during any particular activity and continually improve the accuracy of the switch terminal **12** or equivalent ability to make the appropriate recommendations for changes in the state of adaptive control systems, including but not limited to the illuminance relative to the occupant's or occupant's activity, thus resulting in the continual enhancement of switch terminal **12** or equivalent system performance in delivering the adaptive control system in a space observed by any member of the switch terminal **12** or equivalent. After the computation of these new results has been completed on the server, In one embodiment these results are then transferred back to the originating switch terminal **12** or equivalent via its own

Network Systems **25** connection, or if present via the Network Systems **25** connection of another switch terminal **12** or equivalent that is a member of the same switch terminal **12** or equivalent.

Machine Learning Algorithm

As illustrated in FIG. **8** as a non-limiting example in one embodiment system **10** uses a machine intelligence system **100** for extracting information relative to building occupant switch terminal parameters. In one embodiment system **100** is independent of system **10** and can be cloud based, at a backend end of system **10**, and the like. In another embodiment system **100** is integrated with system **10**. In one embodiment system **10**, with the use of system **100**, uses a combination of a logical inference with a statistical inference and then acts on a knowledge base to provide the platforms changes in operational instructions.

The machine learning algorithms provide one or more instructions for the operation of an adaptive control system relating to building automation relative to at least one of building occupant switch terminal parameters. In one embodiment system **10** uses platforms that are used by system **10** to build platforms by extracting patterns from larger datasets of a building occupant's patterns and behaviors relative to adaptive controls systems, including but not limited to load control devices and systems **22**. As non-limiting examples system **10** uses machine learning analytics of one or more building occupants; for one or more of (i) learned types of activities a building occupant engages in as well the type of light the occupant uses; (ii) learned types of activities a building occupant engages in as well the type of light the occupant uses without the load control system **16**; (iii) how many building occupants are associated with a building **25**, types of activities, the desired use for those activities and devices **18**, any or any kind of switch terminal activates parameters or actions; extracting information relative a building occupant's behavior relative to load control systems **22** and devices, for platforming, trends and behaviors of building occupants relative to switch terminals and any device **18** in a building, platforming, scoring building occupant data with platforms, forecasting and the like. In one embodiment system **100** maps parameters to an output. As a non-limiting example the platforms use observed parameters of a building occupant at switch terminal **12**, or external to switch terminal **12**, to make a selection of a control law. When the expected output is known, it is compared to an actual output from system **100**. If these outputs match then we the selection is correct, and if not an error occurs, and the estimation of concept is updated. As a non-limiting example system **100** handles each selected and/or desired parameter of a building occupant and provides a sequential output.

In one embodiment a database **27** stores the information created by a building occupant that can then be included in a platform that can be provided in real time at the platforms center **110**. In one embodiment the building occupant behaviors and/or actions information database section **120** stores relative building occupant behaviors and/or actions information in a variety of different formats. In one embodiment the building occupant behaviors and/or actions control learning unit **130** offers a range of the building occupant behaviors and/or actions information set from the building occupant behaviors and/or actions information database unit **103**. In one embodiment the building occupant behaviors and/or actions learning control unit **130** may generate a control based on information that can distinguish between the

normal states or the abnormal state through the learning of building occupant behaviors and/or actions activity in response to information input to one or more multi-layer neural network layers. In one embodiment the building occupant behaviors and/or actions control learning unit **130** receives building occupant behaviors and/or actions information in real time, as well as updated information that are saved in the database section **120** with the updated information being used to update reference information. As a non-limiting example this can be achieved for a set period of time, and the like. In addition, based on control information it may include state information based on the reference information of relative building occupant behaviors and/or actions information, and building automation. As a non-limiting example the building occupant behaviors and/or actions learning unit **130** may include different building occupant behaviors and/or actions steps. In one embodiment the building occupant behaviors and/or actions control learning unit **130** includes features that can set the criterion to building occupant behaviors and/or actions information input in real time and constantly update by using the building occupant behaviors and/or actions algorithm. In one embodiment the building occupant behaviors and/or actions control analysis section **116** is accessed and evaluated. In one embodiment the building occupant behaviors and/or actions control, analysis unit **116** may be generated in real time the building occupant behaviors and/or actions control information and comparative analysis of control based on the information. Information and Control based on information or updates in real time storage, including the adaptive control system status and zone status information **107**.

As a non-limiting example the building occupant behaviors and/or actions control, analysis unit **116** may obtain a building occupant behaviors and/or actions control learning unit **130** using the results generated through the state probabilities 0.0 to 1.0.

Example of an NTB Algorithm

In one embodiment an NTB algorithm is used to provide machine learning analytics for extracting information relative to building occupant switch terminal parameters as illustrated in FIG. **9**.

In one embodiment system the algorithm builds platforms by extracting patterns from larger datasets of a building occupant's patterns and behaviors relative to a building occupant and a switch terminal **12**. As non-limiting examples system **10** uses machine learning analytics of one or more building occupants; for one or more of (i) learned types of activities a building occupant engages in as well the type of light the occupant uses; (ii) learned types of activities a building occupant engages in as well the type of light the occupant uses without the load control system **16**; (iii) how many building occupants are associated with a building **25**, types of activities, the desired use for those activities and devices **18**, any or any kind of switch terminal activates or actions; extracting information relative a building occupant's behavior relative to load control systems **22** and devices, for platforming, trends and behaviors of building occupants relative to switch terminals and any device **18** in a building, platforming, scoring building occupant data with platforms, forecasting and the like.

In one embodiment the NTB algorithm divides a building **25** occupant's entire behavioral data into a plurality of patches relative to switch, including but not limited to switch terminal **12** or equivalents and devices, where each patch is

modeled as a node in the error-free network. In response to this an individual's behaviors, to provide human activity recognition, are modeled as a package transmission process in the network. As a non-limiting example this can be a building occupant moving from one patch to another patch relative to a switch terminal **12** or equivalent can be modeled as a package transmitted from one node to another. In this way, various machine learning behavior recognition problems can be transferred into the package transmission analysis problem in the network.

As a non-limiting example the process of a building occupant moving among patches as the energy consumed to transmit a package is modeled, the activities are detected with transmission energy features. As a non-limiting example, abnormal activities can be detected if its energies deviate from normal activity transmission energy by larger than a pre-trained threshold. As a non-limiting example this can be if a building occupant moves to an unusual patch, the energy used is increased and this is detected as an abnormal activity. In this way, the abnormal detection problem can be modeled as the energy efficient transmission problem in a network.

In one embodiment, the following actions are taken; (a) divide the scene into patches. (b) model each patch in (a) as a node in the network and the edges between nodes are modeled as the activity correlation between the corresponding patches. The red trajectory $R(u, q)$ in (a) is modeled by the red package transmission route in (b). (Note that (b) can be a fully connected network (i.e., each node has edges with all the other nodes in the network).

In one embodiment in order to ease the description only the four neighboring edges are drawn for each node). Furthermore, besides modeling the correlation between the building occupant and the scene the network-based model can also be easily extended for handling the interaction among people.

In one embodiment a relative network can be structured where one building occupant is always located in the center of the network and the movement of another building occupant can be modeled as the package transmission process in this "relative" network based on his relative movement to the network-center building occupant. In this way, the interaction among people can also be effectively recognized by evaluating different transmission energies in the network-based model.

In one embodiment the DT energy (activity correlation) is calculated and then an analysis is performed.

In one embodiment of the NTB algorithm modeling is performed as a node in a network. Activity correlations estimated based on the training data and these activity correlations can be used as the edge values in the network.

With these nodes and edges, the networks can be constructed. At the same time, the activity detection rules are also derived from a building occupant's data for detecting activities of interest during the testing process. In the testing process, after obtaining trajectories of people (which represent activities); their corresponding transmission energies are first calculated based on the constructed network.

These transmission energies are analyzed and the activity detection rules can be applied for detecting the activities. Furthermore, several things need to be mentioned about the NTB algorithm. Although there are other works trying to segment the scene into parts for activity recognition, the NTB algorithm is different from them in; (a) the NTB algorithm for a building occupant's behavior is constructed with a package transmission network over the patches while other works use graphical models for recognition. While the

fixed structures of the graphical models may limit their ability to handle various unexpected cases the fully-connected transmission network is more general and flexible for handling various scenarios.

In one embodiment of activity rules an implementation can be different for different activity recognition scenarios. In one embodiment the NTB algorithm is utilized in abnormal event or scene-related activity detection, and group activity recognition. In one embodiment the NTB algorithm in abnormal event detects abnormal activities, including but not limited to a building occupant following irregular parameters and a building occupant moving.

In one embodiment the NTB algorithm divides the scene into parameters.

In one embodiment a building occupant activity or action is calculated as follows:

Let $R(u, q)$ be the building occupant trajectory of the current activity with u being the starting patch and q being the building occupant's current patch. Also define the Direct Transmission (DT) energy for the edge between patches i and j as $e(i, j)$ (i.e., the energy used by directly transmitting a package from patch i to j without passing through other patches, as can be described in detail in the next subsection). The total transmission energy for the trajectory R can be calculated by accumulating the DT energies of all patch pairs in the trajectory, as in

$$E(u, q) = \sum_{(i,j) \in R(u,q)} e(i, j)$$

As a non-limiting example the total transmission energy $R(u, q)$ equals to $e(u, m) + e(m, n) + e(n, q)$. The DT energy (activity correlation) is calculated between patches. The edges between nodes in the network are modeled by the Direct Transmission (DT) energy between patches. In order to calculate the DT energy, an activity correlation AC is introduced between patches. When there are high chances for people to perform activities between two patches i and j (e.g., move across i and j), a high correlation AC (i, j) appears between these patches. Otherwise, a low correlation is. The activity correlation can be calculated by:

Thus, the activity correlation can be calculated by:

$$AC(i, j) = \sum_k tw_k(i, j)$$

Where AC (i, j) is the activity correlation between patches i and j , $tw_k(i, j)$ is the correlation impact weight between i and j from the k -th trajectory in the training data. From this equation the activity correlation AC (i, j) is the summation of correlation impact weights $tw_k(i, j)$ from the training trajectories. If more training trajectories indicate a high correlation between patches i and j , a large activity correlation AC (i, j) can be calculated. With the definition of AC (i, j), the DT energy $e(i, j)$ between patches can be calculated by:

$$e(i,j)=1/AC(i,j)$$

From this equation the DT energy is inversely proportional to the activity correlation. That is, when the activity correlation value AC (i, j) are larger between patches i and j , it implies that a "higher" activity correlation will appear between the patches, resulting in a "lower" DT energy. In this way normal activities (normally go across high-corre-

lation patches) can result in smaller total energies. In one embodiment the correlation impact weights $tw_k(i, j)$ are the key parts for calculating the DT energies.

In one embodiment switch terminal **12** or equivalent provides for adaptive dimming.

In one embodiment switch terminal **12** or equivalent makes all of decisions with its back-end without requiring the connection to cloud **21**.

In one embodiment switch terminal **12** or equivalent provides for an adaptive building.

In one embodiment switch terminal **12** or equivalent is used for security. As non-limiting examples, this can be achieved using one or more of using: motion, s. Network System **25** connections, and the light to provide building **25** monitoring which is based, in one embodiment on load control devices **18**.

In one embodiment switch terminal **12** or equivalent can be used for ambient assisted living.

In one embodiment switch terminal **12** or equivalent can be used as a "Concierge" for an on star for a building **25**. In one embodiment switch terminal **12** or equivalent can be used intercom via the light switch

In one embodiment switch terminal **12** or equivalent can be used for any number of different Apps/Services that are run locally or on the cloud. Whether run locally or via the cloud.

In one embodiment switch terminal **12** or equivalent can be used auto dim for sleep.

In one embodiment switch terminal **12** or equivalent provides learning methods and systems for a building.

In one embodiment switch terminal **12** or equivalent provides lighting preferences.

In one embodiment switch terminal **12** or equivalent provides for illuminance levels.

In one embodiment switch terminal **12** or equivalent provides for lighting based on rules derived from machine learning.

In one embodiment switch terminal **12** or equivalent provides building occupant persona identification.

In one embodiment switch terminal **12** or equivalent provides building **25** space mapping.

As a non-limiting example, one embodiment of a cloud system is illustrated in FIGS. **10(a)-(e)**.

The cloud based system **21** includes a third party service provider that can concurrently service requests from several clients without building occupant perception of degraded computing performance as compared to conventional techniques where computational tasks can be performed upon a client or a server within a proprietary intranet. Alternative system **10** back end includes the elements and functions of cloud system **21**.

The third party service provider (e.g., "cloud") supports **17** a collection of hardware and/or software resources. The hardware and/or software resources can be maintained by an off-premises party, and the resources can be accessed and utilized by identified building occupants over Network Systems. Resources provided by the third party service provider can be centrally located and/or distributed at various geographic locations. For example, the third party service provider can include any number of data center machines that provide resources. The data center machines can be utilized for storing/retrieving data, effectuating computational tasks, rendering graphical outputs, routing data, and so forth.

In one embodiment, the third party service provider can provide any number of resources such as servers, CPU's, data storage services, computational services, word process-

ing services, electronic mail services, presentation services, spreadsheet services, web syndication services (e.g., subscribing to a RSS feed), and any other services or applications that are conventionally associated with personal computers and/or local servers. Further, utilization of any number of third party service providers **17** similar to the third party service provider is contemplated. According to an illustration, disparate third party service providers can be maintained by differing off-premise parties and a building occupant can employ, concurrently, at different times, and the like, all or a subset of the third party service providers

By leveraging resources supported by the third party service provider, limitations commonly encountered with respect to hardware associated with clients and servers within proprietary intranets can be mitigated. Off-premises parties, instead of building occupants of clients or network administrators of servers within proprietary intranets, can maintain, troubleshoot, replace and update the hardware resources. Further, for example, lengthy downtimes can be mitigated by the third party service provider utilizing redundant resources; thus, if a subset of the resources are being updated or replaced, the remainder of the resources can be utilized to service requests from building occupants. According to this example, the resources can be modular in nature, and thus, resources can be added, removed, tested, modified, etc. while the remainder of the resources can support servicing building occupant requests. Moreover, hardware resources supported by the third party service provider can encounter fewer constraints with respect to storage, processing power, security, bandwidth, redundancy, graphical display rendering capabilities, etc. as compared to conventional hardware associated with clients and servers within proprietary intranets.

The cloud based system can include a client device **18** that employs resources of the third party service provider **17**. Although one client device **18** is depicted, it is to be appreciated that the cloud based system can include any number of client devices similar to the client device, and the plurality of client devices can concurrently utilize supported resources. By way of illustration, the client device **18** can be a desktop device **18** (e.g., personal computer), motion/movement/gesture detection device, and the like. Further, the client device **18** is an embedded system that can be physically limited, and hence, it can be beneficial to leverage resources of the third party service provider **17**.

Resources can be shared amongst a plurality of client devices subscribing to the third party service provider **17**. According to an illustration, one of the resources can be at least one central processing unit (CPU), where CPU cycles can be employed to effectuate computational tasks requested by the client device. Pursuant to this illustration, the client device can be allocated a subset of an overall total number of CPU cycles, while the remainder of the CPU cycles can be allocated to disparate client device(s). Additionally or alternatively, the subset of the overall total number of CPU cycles allocated to the client device can vary over time. Further, a number of CPU cycles can be purchased by the building occupant of the client device. In accordance with another example, the resources can include data store(s) that can be employed by the client device to retain data. The building occupant employing the client device can have access to a portion of the data store(s) supported by the third party service provider **17**, while access can be denied to remaining portions of the data store(s) (e.g., the data store(s) can selectively mask memory based upon building occupant/device identity, permissions, and the like). It is contemplated that any additional types of resources can likewise be shared.

The third party service provider can further include an interface component that can receive input(s) from the client device and/or enable transferring a response to such input(s) to the client device (as well as perform similar communications with any disparate client devices). According to an example, the input(s) can be request(s), data, executable platform(s), etc. For instance, request(s) from the client device can relate to effectuating a computational task, storing/retrieving data, rendering a building occupant interface, and the like via employing one or more resources. Further, the interface component can obtain and/or transmit data over a network connection. As an illustration, executable code can be received and/or sent by the interface component over the network connection. Pursuant to another example, a building occupant (e.g. employing the client device) can issue commands via the interface component.

The cloud **21** provides for analysis of switch terminal parameters.

Moreover, the third party service provider includes a dynamic allocation component that apportions resources (e.g., hardware resource(s)) supported by the third party service provider to process and respond to the input(s) (e.g., request(s), data, executable platform(s) and the like) obtained from the client device.

Although the interface component is depicted as being separate from the dynamic allocation component, it is contemplated that the dynamic allocation component can include the interface component or a portion thereof. The interface component can provide various adaptors, connectors, channels, communication paths, etc. to enable interaction with the dynamic allocation component.

FIGS. **11-13** illustrate one embodiment of a mobile device **23** that can be used with the present invention.

The switch terminal **12** or equivalent **18** can include a display that can be a touch sensitive display. The touch-sensitive display is sometimes called a "touch screen" for convenience, and may also be known as or called a touch-sensitive display system. The switch terminal **12** or equivalent **18** may include a memory (which may include one or more computer readable storage mediums), a memory controller, one or more processing units (CPU's), a peripherals interface, Network Systems circuitry, including but not limited to RF circuitry, audio circuitry, a speaker, a microphone, an input/output (I/O) subsystem, other input or control devices, and an external port. The switch terminal **12** or equivalent **18** may include one or more optical sensors. These components may communicate over one or more communication buses or signal lines.

It should be appreciated that the switch terminal **12** or equivalent **18** is only one example of a portable multifunction switch terminal **12** or equivalent, and that the switch terminal **12** or equivalent **18** may have more or fewer components than shown, may combine two or more components, or a may have a different configuration or arrangement of the components. The various components may be implemented in hardware, software or a combination of hardware and software, including one or more signal processing and/or application specific integrated circuits.

Memory may include high-speed random access memory and may also include non-volatile memory, such as one or more magnetic disk storage devices, flash memory devices, or other non-volatile solid-state memory devices. Access to memory by other components of the switch terminal **12** or equivalent, such as the CPU and the peripherals interface, may be controlled by the memory controller.

The peripherals interface couples the input and output peripherals of the device **18** to the CPU and memory. The

one or more processors run or execute various software platforms and/or sets of instructions stored in memory to perform various functions for the switch terminal **12** or equivalent **18** and to process data.

In some embodiments, the peripherals interface, the CPU, and the memory controller may be implemented on a single chip, such as a chip. In some other embodiments, they may be implemented on separate chips.

The Network System circuitry receives and sends signals, including but not limited to RF, also called electromagnetic signals. The Network System circuitry converts electrical signals to/from electromagnetic signals and communicates with communications Network Systems and other communications devices via the electromagnetic signals. The Network Systems circuitry may include well-known circuitry for performing these functions, including but not limited to an antenna system, an RF transceiver, one or more amplifiers, a tuner, one or more oscillators, a digital signal processor, a CODEC chipset, a subscriber identity module (SIM) card, memory, and so forth. The Network Systems circuitry may communicate with Network Systems and other devices by wireless communication.

The wireless communication may use any of a plurality of communications standards, protocols and technologies, including but not limited to Global System for Mobile Communications (GSM). Enhanced Data GSM Environment (EDGE), high-speed downlink packet access (HSDPA), wideband code division multiple access (W-CDMA), code division multiple access (CDMA), time division multiple access (TDMA). BLUETOOTH®. Wireless Fidelity (Wi-Fi) (e.g., IEEE 802.11a, IEEE 802.11b, IEEE 802.11g and/or IEEE 802.11n), voice over Internet Protocol (VoIP). Wi-MAX, a protocol for email (e.g., Internet message access protocol (IMAP) and/or post office protocol (POP)), instant messaging (e.g., extensible messaging and presence protocol (XMPP), Session Initiation Protocol for Instant Messaging and Presence Leveraging Extensions (SIMPLE), and/or Instant Messaging and Presence Service (IMPS)), and/or Short Message Service (SMS)), or any other suitable communication protocol, including communication protocols not yet developed as of the filing date of this document.

The audio circuitry, the speaker, and the microphone provide an audio interface between a building occupant and the switch terminal **12** or equivalent. The audio circuitry receives audio data from the peripherals interface, converts the audio data to an electrical signal, and transmits the electrical signal to the speaker. The speaker converts the electrical signal to human-audible sound waves. The audio circuitry also receives electrical signals converted by the microphone from sound waves. The audio circuitry converts the electrical signal to audio data and transmits the audio data to the peripherals interface for processing. Audio data may be retrieved from and/or transmitted to memory and/or the Network Systems circuitry by the peripherals interface. The I/O subsystem couples input/output peripherals on the switch terminal **12** or equivalent, such as the touch screen and other input/control devices, to the peripherals interface. The I/O subsystem may include a display controller and one or more input controllers for other input or control devices. The one or more input controllers receive/send electrical signals from/to other input or control devices. The other input/control devices may include physical buttons (e.g., push buttons, rocker buttons, etc.), dials, slider switches, and joysticks, click wheels, and so forth. In some alternate embodiments, input controller(s) may be coupled to any (or none) of the following: a keyboard, infrared port, USB port, and a pointer device **18** such as a mouse. The one or more

buttons may include an up/down button for light control of the dimmer, volume control of the speaker and/or the microphone. The one or more buttons may include a push button. A quick press of the push button may disengage a lock of the touch screen or begin a process that uses gestures on the touch screen to unlock the device, as described in U.S. patent application Ser. No. 11/322,549, "Unlocking a Device **18** by Performing Gestures on an Unlock Image." filed Dec. 23, 2005, which is hereby incorporated by reference in its entirety. A longer press of the push button may turn power to the computing device **18** on or off. The building occupant may be able to customize a functionality of one or more of the buttons. The touch screen is used to implement virtual or soft buttons and one or more soft keyboards.

The touch-sensitive sensor or touch screen provides an input interface and an output interface between the devices and a building occupant. The display controller receives and/or sends electrical signals from/to the touch screen. The touch screen displays visual output to the building occupant. The visual output may include graphics, text, icons, video, and any combination thereof (collectively termed "graphics"). In some embodiments, some or all of the visual output may correspond to building occupant-interface objects, further details of which are described below.

A touch screen has a touch-sensitive surface, sensor or set of sensors that accepts input from the building occupant based on haptic and/or tactile contact. The touch screen and the display controller (along with any associated modules and/or sets of instructions in memory) detect contact (and any movement or breaking of the contact) on the touch screen and converts the detected contact into interaction with building occupant-interface objects (e.g., one or more soft keys, icons, web pages or images) that are displayed on the touch screen. In an exemplary embodiment, a point of contact between a touch screen and the building occupant corresponds to a finger of the building occupant.

The touch screen may use LCD (liquid crystal display) technology, or LPD (light emitting polymer display) technology, although other display technologies may be used in other embodiments. The touch screen and the display controller may detect contact and any movement or breaking thereof using any of a plurality of touch sensing technologies now known or later developed, including but not limited to capacitive, resistive, infrared, and surface acoustic wave technologies, as well as other proximity sensor arrays or other elements for determining one or more points of contact with a touch screen.

A touch-sensitive display in some embodiments of the touch screen may be analogous to the multi-touch sensitive tablets described in the following U.S. Pat. No. 6,323,846 (Westerman et al.), U.S. Pat. No. 6,570,557 (Westerman et al.), and/or U.S. Pat. No. 6,677,932 (Westerman), and/or U.S. Patent Publication 2002/0015024A1 each of which is hereby incorporated by reference in their entirety. However, a touch screen displays visual output from the portable switch terminal **12** or equivalent, whereas touch sensitive tablets do not provide visual output.

A touch-sensitive display in some embodiments of the touch screen may be as described in the following applications: (1) U.S. patent application Ser. No. 11/381,313, "Multipoint Touch Surface Controller," filed May 12, 2006; (2) U.S. patent application Ser. No. 10/816,862, "Multipoint Touchscreen," filed May 6, 2004; (3) U.S. patent application Ser. No. 10/903,964, "Gestures For Touch Sensitive Input Devices," filed Jul. 30, 2004; (4) U.S. patent application Ser. No. 11/048,254. "Gestures For Touch Sensitive Input Devices," filed Jan. 31, 2005; (5) U.S. patent application Ser.

No. 11/038,590, "Mode-Based Graphical Building occupant Interfaces For Touch Sensitive Input Devices." filed Jan. 18, 2005; (6) U.S. patent application Ser. No. 11/228,758. "Virtual Input Device Placement On A Touch Screen Building occupant Interface." filed Sep. 16, 2005; (7) U.S. patent application Ser. No. 11/228,700. "Operation Of A Computer With A Touch Screen Interface," filed Sep. 16, 2005; (8) U.S. patent application Ser. No. 11/228,737, "Activating Virtual Keys Of A Touch-Screen Virtual Keyboard." filed Sep. 16, 2005; and (9) U.S. patent application Ser. No. 11/367,749, "Multi-Functional Hand-Held Device," filed Mar. 3, 2006. All of these applications are incorporated by reference herein in their entirety.

The touch screen display may have a resolution in excess of 1000 dpi. In an exemplary embodiment, the touch screen has a resolution of approximately 1020 dpi. The building occupant may make contact with the touch screen using any suitable object or appendage, such as a stylus, a finger, and so forth. In some embodiments, the building occupant interface is designed to work primarily with finger-based contacts, which are much less precise than stylus-based input due to the larger area of contact of a finger on the touch screen. In some embodiments, the device translates the rough finger-based input into a precise pointer/cursor position or command for performing the actions desired by the building occupant.

In some embodiments, in addition to the touch screen or instead of a touch screen, the switch terminal **12** or equivalent may include a touchpad (not shown) for activating or deactivating particular functions. In some embodiments, the touchpad is a touch-sensitive area of the device that, unlike the touch screen, does not display visual output. The touchpad may be a touch-sensitive surface that is separate from the touch screen or an extension of the touch-sensitive surface formed by the touch screen.

In some embodiments, the switch terminal **12** or equivalent may include a physical or virtual click wheel as an input control device. A building occupant may navigate among and interact with one or more graphical objects (henceforth referred to as icons) displayed in the touch screen by rotating the click wheel or by moving a point of contact with the click wheel (e.g., where the amount of movement of the point of contact is measured by its angular displacement with respect to a center point of the click wheel). The click wheel may also be used to select one or more of the displayed icons. For example, the building occupant may press down on at least a portion of the click wheel or an associated button. Building occupant commands and navigation commands provided by the building occupant via the click wheel may be processed by an input controller as well as one or more of the modules and/or sets of instructions in memory. For a virtual click wheel, the click wheel and click wheel controller may be part of the touch screen and the display controller, respectively. For a virtual click wheel, the click wheel may be either an opaque or semitransparent object that appears and disappears on the touch screen display in response to building occupant interaction with the device. In some embodiments, a virtual click wheel is displayed on the touch screen of a portable multifunction device and operated by building occupant contact with the touch screen.

The switch terminal **12** or equivalent also includes a power system for powering the various components. The power system may include a power management system, one or more power sources (e.g., battery, alternating current (AC)), a recharging system, a power failure detection circuit, a power converter or inverter, a power status indicator (e.g.,

a light-emitting diode (LED)) and any other components associated with the generation, management and distribution of power in portable devices.

The switch terminal **12** or equivalent may also include one or more sensors, including not limited to optical sensors. In one embodiment an optical sensor is coupled to an optical sensor controller in I/O subsystem. The optical sensor may include charge-coupled device (CCD) or complementary metal-oxide semiconductor (CMOS) phototransistors. The optical sensor receives light from the environment, projected through one or more lens, and converts the light to data representing an image. In conjunction with an imaging module (also called a camera module); the optical sensor may capture still images or video. In some embodiments, an optical sensor is located on the front of the device so that the building occupant's image may be obtained for videoconferencing while the building occupant views the other video conference participants on the touch screen display. In some embodiments, the position of the optical sensor can be changed by the building occupant (e.g., by rotating the lens and the sensor in the device housing) so that a single optical sensor may be used along with the touch screen display for both video conferencing and still and/or video image acquisition.

The switch terminal **12** or equivalent may also include one or more proximity sensors. In one embodiment, the proximity sensor is coupled to the peripherals interface. Alternately, the proximity sensor may be coupled to an input controller in the I/O subsystem. The proximity sensor may perform as described in U.S. patent application Ser. No. 11/241,839. "Proximity Detector In Handheld Device." filed Sep. 30, 2005; Ser. No. 11/216,788, "Proximity Detector In Handheld Device," filed Sep. 30, 2005; Ser. No. 13/096,386. "Using Ambient Light Sensor To Augment Proximity Sensor Output"; Ser. No. 13/096,386. "Automated Response To And Sensing Of Building occupant Activity In Portable Devices," filed Oct. 24, 2006; and Ser. No. 11/638,251, "Methods And Systems For Automatic Configuration Of Peripherals," which are hereby incorporated by reference in their entirety. In some embodiments, the proximity sensor turns off and disables the touch screen when the building occupants are not near the device **18**.

In some embodiments, the software components stored in memory may include an operating system, a communication module (or set of instructions), a contact/motion module (or set of instructions), a graphics module (or set of instructions), a text input module (or set of instructions), a Global Positioning System (GPS) module (or set of instructions), and applications (or set of instructions).

The operating system (e.g., Darwin, RTXC, LINUX, UNIX, OS X, WINDOWS, or an embedded operating system such as VxWorks) includes various software components and/or drivers for controlling and managing general system tasks (e.g., memory management, storage device control, power management, etc.) and facilitates communication between various hardware and software components.

The communication module facilitates communication with other devices over one or more external ports and also includes various software components for handling data received by the Network Systems circuitry and/or the external port. The external port (e.g., Universal Serial Bus (USB), FIREWIRE, etc.) is adapted for coupling directly to other devices or indirectly over Network System.

The contact/motion module may detect contact with the touch screen (in conjunction with the display controller) and other touch sensitive devices (e.g., a touchpad or physical click wheel). The contact/motion module includes various

software components for performing various operations related to detection of contact, such as determining if contact has occurred, determining if there is movement of the contact and tracking the movement across the touch screen, and determining if the contact has been broken (i.e., if the contact has ceased). Determining movement of the point of contact may include determining speed (magnitude), velocity (magnitude and direction), and/or an acceleration (a change in magnitude and/or direction) of the point of contact. These operations may be applied to single contacts (e.g., one finger contacts) or to multiple simultaneous contacts (e.g., "multitouch"/multiple finger contacts). In some embodiments, the contact/motion module and the display controller also detect contact on a touchpad. In some embodiments, the contact/motion module and the controller detects contact on a click wheel.

Examples of other applications that may be stored in memory include other word processing applications, JAVA-enabled applications, encryption, digital rights management, voice recognition, and voice replication.

As illustrated in FIG. 14 in one embodiment an antenna 210, which as a non-limiting example can be a dual-band slot antenna 210, is integrated and/or coupled to the electrical circuit 28, which as a non-limiting example can be a printed circuit board 28, of the computing device 14 which includes at least two radio circuits 218 and 220 to provide a network interface to switch terminal 10.

In one embodiment the electrical circuit 28 is coupled to a metal frame 212 with fasteners 214. Electrical contact is made only at defined points between the metal frame 210 and the electrical circuit 28. In one embodiment the slot antenna 210 is void of all metal except at a feed point 216.

In one embodiment the functional dual-band slot antenna 210 provides tuning and VSWR performance depend on other components in system 10.

As a non-limiting example antenna 210 can be used by first and second independent radio circuits 218 and 220 simultaneously that can be included in computer 14. As a non-limiting example this is achieved by using a diplexer circuit 222, which can be an RF diplexer circuit. As a non-limiting example the diplexer circuit 222 can be a combination of low pass/high pass filters 224. As a non-limiting example the diplexer circuit 222 can significantly attenuate signals from opposing radio circuits 218 and 220. FIG. 15, with associated receivers.

In one embodiment the diplexer circuit 220 conditions the signal by splitting the incoming signal into low and high frequency bands at the appropriate energy levels for the receivers of radio circuits 218 and 220.

In one embodiment the diplexer circuit 22 includes two or more filters 224 that can that can: (i) protect one radio circuit receiver from the transmission power of the other radio circuit receiver and (ii) prevent out-of-band noise received by an antenna from reaching the receiver of each radio circuit 218 and 220. In one embodiment one filter 224 is a low pass filter, and a second filter 224 is a high pass filter.

In one embodiment the two or more filters 224 of diplexer circuit 222 help condition the incoming signal for each associated receiver of radio circuits 218 and 220. In one embodiment the feed point 216 to antenna 210 is connected to a common terminal of the diplexer circuit 222.

As a non-limiting example the receivers of radio circuits 218 and 220 can be utilized for any frequency. As a non-limiting example the frequencies of the radio circuits 218 and 220 can be in the range of 20 MHz-300 MHz. In one specific example the frequencies of the radio circuits 218 and 220 can be 915 MHz and 2.4 GHz respectively. In one

embodiment one of the filters 224 is a low pass filter and the second filter 224 is a high pass signal.

As a non-limiting example the low pass filter 224 is positioned between antenna 210 and radio circuit 218 and the high pass filter 224 is positioned between antenna 210 and radio circuit 220. As a non-limiting example this provides isolation, prevents damage to the radio circuits 218 and 220 from a transmit power of the other radio.

As illustrated in FIG. 16 a power management system, which can be a power supply system 32 (hereafter power management system 32) and power monitoring system 40, which can be circuitry are provided. In one embodiment each switch terminal 12 has at least a plurality of wiring terminals 312. Because there is no specific configuration of the wiring terminals 312 to a specific wiring element/circuit 314, the power management system 32 and power monitoring system 40 can be said to be interchangeable, and a wiring terminal 312 element can be interchangeable with a wiring element 314. The switch terminal 12 is coupled to the electrical system (circuit) 28 of a building 25 by connecting the wiring elements 314 of the building 25 to the wiring terminals 312 of the switch terminal 12.

In one embodiment power management system 32 can include an AC/DC converter 316, a variable resistance control system (MOSFET) 318, an analog front end 320 and MCU 34. In one embodiment the power monitoring circuit 312 monitors the power characteristics and can utilize MCU 34. In one embodiment the power monitoring circuit 312 is an analog front end.

As illustrated in FIG. 17 in one embodiment switch terminal 12 includes a plurality of wiring terminals 312. In one embodiment the plurality of wiring terminals are at an exterior of the switch terminal 12. In one embodiment the plurality of wiring terminals are at a back surface of the switch terminal 12. In one embodiment the wiring elements 314 of an electrical circuit 28 can be coupled to a back end or at an exterior surface back end of switch terminal 12. The wiring terminals 312 are configured to be connected to the wiring of the lighting circuit. There is no set configuration connection of a wiring element 314 to a specific element of a wiring terminal 312.

In one embodiment there is no singular and specific configuration of which wiring terminal 312 is connected to a wiring element 314 (circuits). This is in contrast to existing switch terminals 12. Interchangeable means that the wiring element configuration to switch terminal 12 does not matter. It does not matter which wiring element 314 (circuit) is connected to which wiring terminal 312 irrespective of order as long as there are the correct number of wiring elements 314 is connected irrespective of the order.

As a non-limiting example the input an AC voltage waveform to run the switch terminal's electronics is rectified on DC voltage. When AC line terminals feed independent bridge rectifiers the circuit can then use whichever of them has AC line power connected to it to generate the DC power for the rest of system 10. As a non-limiting example each MOSFET 318 is essentially a solid state switch between the two AC Line terminals and they do not care which wiring terminal 312 is input and which output is.

In one embodiment four wiring elements 314 and two line wiring elements 314 are provided. One is connected to power management system 32 and another is connected to the electrical load. A neutral wiring element 314 is connected to the common power wiring elements 314 of the circuit and a ground wiring element 314. In another embodiment three wiring elements 314 and two line wiring elements 314 are provided. One is connected to the power

management system **32** and another connected to the electrical load. A ground wiring element **314** is provided. In another embodiment a specific configuration is similarly not required but only that the type of wiring element **314** be connected to the appropriate type of wiring terminal element of a wiring terminal **312**. In this embodiment ground wiring elements **314** are connected to a ground terminal, line wiring elements **314** are connected to line terminals of a wiring terminal **312** and neutral wiring elements **314** are connected to neutral terminals of wiring terminal **312**, but the specific connection of wiring elements **314** with the specific terminals of wiring terminal **312** these types does not matter. The plurality of wiring elements **314**, circuits, manipulate the energy so that the switch terminal **12** is powered. Because there is no specific configuration of a wiring terminal **312** to a wiring element (circuit) **314** the wiring terminals **312** and wiring elements **314** are interchangeable and there is not set configuration of a wiring element **314** to terminals of a wiring terminal **312**. This provides for interchangeability of wiring elements **314** to elements of a wiring terminal **312**.

This makes it easy for a building occupant to connect the switch terminal **12**.

As illustrated in FIG. **18** In one embodiment one or more switch terminals **12** includes or is coupled to a motion and or person presence detector, interface, sensor and the like (hereafter collectively “motion detection sensor **410**”. As a non-limiting example motion detection sensor **410** is used for security purposes of building **25**. In one embodiment motion detection sensor **410** is used to detect different types of human movement, presence and human identification. As non-limiting examples motion detection sensors **410** can be used for local event sensing, area sensing and the like.

In one embodiment motion detection sensor **410** can be used to detection of unauthorized entry, detection of cessation of occupancy of an area to extinguish lighting, and detection of a moving object which triggers a camera to record subsequent events and the like. In one embodiment switch terminal **12** is coupled with platforms on the computing device **14** and configured to detect anomalies as they relate to the entirety of the building **25** as a whole or as individual zones. A building occupant can configure which zones are being observed. Individual trigger settings and rules can be specified for each of these internal zones to allow for differential treatment of anomalous behaviors within specific zones or the building **25** as a whole.

In one embodiment the motion detection sensor **410** is a motion detection sensor **410**. As used herein motion detection sensor **410** is any kind of sensing system which is used to detect motions; motion of any object or human as well as presence of a human in a certain area of building **25**. In one embodiment a motion detection sensor **410** is a device that detects the physical movement in a given area/designated locations and it transforms motion into an electric signal. In one embodiment the system **10** with motion detection sensor **410** provides an indication that some condition has changed. In one embodiment all motion detection sensors **410** have some ‘normal’ state. Some motion detection sensors **410** only report when the ‘normal’ status is disturbed, others also report when the condition reverts to ‘normal’.

In one embodiment one or more platforms within computing device **14** determine if the signals received by a motion detection sensor **410** represent an anomaly relative to a known acceptable pattern and identify that anomaly to the platforms for handling by their logic and the capabilities and/or connections of the system **10**. As a non-limiting example the system **10** using motion detection sensor **410** indicates that some condition has changed.

As non-limiting examples motion detection sensor **410** can include but is not limited to: infrared (passive and active sensors); optics (video and camera systems); radio frequency energy (radar, microwave and tomographic motion detection); sound (microphones and acoustic sensors); vibration (triboelectric, seismic, and inertia-switch sensors); magnetism (magnetic sensors and magnetometers),); vibration (triboelectric, seismic, and inertia-switch sensors); magnetism (magnetic sensors and magnetometers); visible/infrared light(LED/Laser) beam; contact switch; piezoelectric sensors; ultrasonic, motion detection sensors; footstep detection; microwave Doppler sensors; sonar; echolocation and the like.

As a non-limiting example one or more algorithms can be used to compare one sensed motion, presence and like, to a base value that can be in a database, including but not limited to database **27** which can be located or in cloud system **21**.

As non-limiting examples motion detection sensor **410** can: generate some stimulus and sensing its reflection; sense some signals generated by an object, and the like.

In one embodiment when motion is detected motion detection sensor **410** generates an electrical signal based on which some actions are taken.

In one embodiment motion detection sensor **410** is coupled to an alarm device or system **414**. In one embodiment a trigger signal from motion detection sensor **410** is transmitted to one or more control unit(s) **416** either through wires or wireless (radio, line carrier, infrared and the like).

As a non-limiting example the alarm output can be local, remote or a combination. As a non-limiting example alarm device or system can connect to server at a central station or first responder (e.g. police/fire/medical) via a direct phone wire, a cellular network, a radio network (i.e. GPRS/GSM), or an IP path.

In various embodiments the alarm device or system can be lights that can be flashed; a sound can be emitted; an alarmed activated; a signal provided to another system for response including but not limited to locking the doors, windows and the like; activating another systems response; a signal can be sent to a remote system, e.g., cloud system for handling to include the triggering of a response by an autonomous system or a human monitored system for intervention by that monitor.

In one embodiment the alarm device or system can be coupled to Network System **25** to deliver a detection of the anomaly to a server which can be in the cloud system **21**, a local building **25** server and the like.

In one embodiment motion detection sensor **410** gathers data of motion. A processor processes the motion data gathered by the motion detection sensor **410**. An executing interface can be provided that is capable of two-way transferring the sensed data between the processor and storage which can be a local or non-local database. As a non-limiting example storage can provide for: false positive detection and; storing for receiving the data being calculated by algorithms through a microprocessor that can be included in computing device **14**, cloud system and the like.

In one embodiment switch terminal **12** or equivalent, computer system **14**, one or more sensors **15** with one or more switch terminal parameters relative to the building **25**, are utilized for controlling lighting in all or a selection section of building **25** provides for selecting different lighting conditions consistent with a building occupant’s circadian rhythm. As a non-limiting example n all or a portion of building **25** for different activities, including but not limited to sleep, for different times of the day.

Circadian rhythm disorders are disruptions in a person's circadian rhythm—a name given to the “internal body clock” that regulates the (approximately) 24-hour cycle of biological processes. There are patterns of brain wave activity, hormone production, cell regeneration, and other biological activities linked to this 24-hour cycle.

The circadian rhythm is important in determining sleeping patterns such as when we sleep and when we wake, every 24 hours. The normal circadian clock is set by the light-dark cycle over 24 hours.

As a non-limiting example, wavelengths for “blue” light can keep the pineal gland from releasing melatonin, thus warding off sleepiness. If enough blue light hits the eye, the gland can stop releasing melatonin. So easing into bed with a tablet or a laptop makes it harder to take a long snooze, especially for sleep-deprived teenagers who are more vulnerable to the effects of light than adults.

As a non-limiting example a building occupant switch terminal parameter the learning switch terminal parameter for a person from system 10, provides an understanding of historical patterns of the a building occupants preferred amount of light for a given instance of human occupancy in a space in a coincident set of contextual factors. Historical data, current activates, presence, building occupant intent, type of space, time of day, connection of movement of a building occupant from one space to another in order to provide a proffered amount of light for functional purposes, this can include psychological and health related matters

Additionally the building occupant switch terminal parameter is used to identify the actual building occupant and provide for suitable lighting conditions relative to that building occupant's normal circadian clock.

As illustrated in FIG. 19 in one embodiment one or more switch terminals 12 includes wiring components 30 that are secured to circuitry wiring 31 without screw terminals or fixed friction connect terminals. In one embodiment all or a portion of switch terminals 12 include a locking mechanism 512 that couples wiring components 30 securely to circuitry wiring 31 without external live points of contact, e.g., external live points of contact including but not limited to screw terminals and the like. Locking mechanism 512 provides for quick capture and release. In this embodiment the circuitry wiring 31 is isolated internally to switch terminal 12 without external points of live contact. In one embodiment this is achieved without the use of a tool and is non-destructive to circuitry wiring 31 which can be inserted, removed, reinserted and the like A person can insert the wiring components 30 into the switch terminal 12 via exposed openings at the external housing of the switch terminal 12.

A circuitry wiring 31 enters a channel of switch terminal 12 and engages with the locking mechanism 512 that first releases to allow the wiring component 30 to make contact with the enclosed circuitry wiring 31. Once the contact has been achieved locking mechanism 512 locks the wiring components 30 into contact with the circuitry wiring 31.

In one embodiment locking mechanism 512 is a mechanical element, magnetic element, electrical element and the like. In one embodiment lock mechanism 512 can be spring loaded. As a non-limiting example locking mechanism 512 keeps the wiring components 30 and circuit wiring 31 in contact with one another and resists the decoupling of that contact that could result from the circuit wiring 31 being pulled out of switch terminal 12. This can be repeated for any and all of the required couplings needed to power the switch terminal 12.

If the building occupant desires to decouple the contact the building occupant can activate locking mechanism 512 that is external to the switch terminal 12 to release the coupling of wiring components 30 and locking mechanism, e.g., circuit wiring 31. The locking mechanism deactivates the locking elements allowing the wiring components 31 to be pulled out of the switch terminal 12. This removal is achieved without the destroying the circuit wiring 31 allowing it to be re-inserted in the same or another opening to achieve the coupling. In one embodiment locking mechanism 512 provides a pivot element 514 with a pivot point 516, a release mechanism 518, and a pivoted bar 520, including but not limited to a Pawl, coupled to the pivot element 514. A spring element 522 can be configured to act on pivot element 514. As a non-limiting example the pivoted bar 520 is adapted to engage with the circuitry wiring 31. As non-limiting examples the engagement can be by teeth 524 or other engagement devices to prevent movement and/or to impart motion. In one embodiment the locking mechanism is sliding element, a button, and the like to interact with the pivot element.

As illustrated in FIG. 20 in one embodiment in response to system 10, more particularly one or more building occupant switch terminal parameters and the one or more sensors 15, knowledge is obtained of how the sensors 15 relate to each other, and how system 10 and/or sensors 15 should be operating anywhere in the building 25. As a non-limiting example spatial relationship information of devices 12 is determined. As a non-limiting example for the purpose of enabling the prediction of activity by a building occupant and the creation of spatial relations of devices, links 610 between switch terminals 12 in a building 25 and/or a space in a building 25 are determined. As a non-limiting example these links 610 between switch terminals 12 are used to control spaces and or zones in a building 25, as well as detect anomalies. As a non-limiting example anomalies can include but are not limited to: anomalies in sensor outputs such as ambient or artificial light, movement by warm bodies, sound including but not limiting to falls, like falls, glass breaking or utterances by people, electrical properties, in the detection of presence of human beings and the like.

In this manner the building 25 is not programmed based on observation, by a set of actual building 25 plans, and the like. In one embodiment not programmed is knowledge gained from the spatial relationships of switch terminals 12. As non-limiting examples not programmed means that the user has not provide explicit or implicit program to help structure the systems operation and collection of inputs such as defining the spaces of a building 25, the relationships of one space to another, and the like.

As a non-limiting example relationships of frequented spaces in a building 25 are determined relative to other spaces in the building 25, including but not limited to how relationships of frequented spaces relate to other spaces. In one embodiment system 10 knows know how the sensors 15 relate to each other and what they should be doing anywhere in a building 25 based on predictive behaviors of building occupants.

In one embodiment an optimization of environmental conditions in a building 25 is created in response to one or more building occupant switch terminal parameters and the one or more sensors 15. As a non-limiting example environmental conditions include but are not limited to: ambient light levels as provided by natural light, ambient light levels as provided by artificial sources, temperature of different spaces, sound levels of any sound emitting device including those of first and second parties in building 25. As a

non-limiting example the spatial relationship information can provide for greater information for system 10.

Knowledge of spatial relationships of switch terminals 12 relative to each other can determine aspects of system 10 that can independent of building occupant actions. In one embodiment, the knowledge of spatial relationship information relative to switch terminals 12 provides information relative to a building's functions, a building occupant activities relative to building 25 and the like, (hereafter "Functions and/or Activities") including but not limited to: (i) sensor 15 validity; (ii) which sensors 15 apply and should be used for information; (iii) what sensor 15 input to use; (iv) the number of entrances into a room/space by one or more persons; (v) a person's entrance or exit to and from a room/space; (vi) additional intelligence relative to activity in a room/space; (vi) are devices co-located in the same space; (vii) sensor 15 co-location; (viii) scores for collation of sensors 15, and the like

The Functions and/or Activities also include the following: sleep, hanging out, change clothes, romantic time, nap/relax, watch TV before sleep, play video games, shower, shower, wash hand, take a bath, shave/personal care, wash pets, watch TV at any time, have a gathering/party, eat food, read a book, play video games, eat food with others, gathering/chat, do it yourself project space, cooking, washing dishes/chores, getting something from the fridge, washing hands, making coffee/tea, getting snacks, putting things in the refrigerator after grocery shopping, eating/drinking if open kitchen, walk from front door to inside house, walk from room to room, gathering/hangout, get some fresh air, get ready for day, choose what to wear, change clothes, put clothes/stuff in closet to be stored, finding objects or people, organizing, take things out, gaming if it's a game room TV), filing, take things out, park car, get in the car to go out, work for hours at a time, store documents, fill out forms, read a book, play video games, play board games, watch TV/movies, hang out with friends, lighting, temperature control, multi-media, security, window and door operations, air quality, or any other task of necessity or comfort performed by a building resident, with the rise of wireless computerization, remote-controlled devices can be smart just-in-time.

As a non-limiting example in response to one or more building occupant switch terminal parameters and the one or more sensors 15 Functions and/or Activities within a building 25 can be adjusted as a building occupant passes by and through the building 25. This can be used to create a "smart or intelligent building".

As a non-limiting example maps and/or links 610 of spatial relationships allows for the mapping of building occupants in a building 25 including its spaces, for optimization and measurement that can include: anomalies, number of building occupants, activities in that space, predictions of future activities, and the link. In this matter an intelligent building is created for subsequent future actions that are utilized in the building 25.

As a non-limiting example system can determine as determine the following: "Should system 10 light up c when a and b happens in response to one or more building occupant switch terminal parameters and the one or more sensors 15

System 10 knows the relationships of the switch terminals 12 in response to one or more building occupant switch terminal parameters and the one or more sensors 15

In one embodiment Link Layer Discovery Protocol (LLDP) is used by switch terminals 12, sensors 15, and the like for advertising their identity, capabilities, and neighbors on an IEEE 802 local area network. The protocol is formally

referred to by the IEEE as Station and Media Access Control Connectivity Discovery specified in IEEE 802.1AB and IEEE 802.3-2012 section 6 clause 79.

In one embodiment coded signals are sent through the building's wiring, and/or sent wirelessly, to switch terminals 12 that are programmed to operate appliances and electronic devices in every part of the building 25. It involves the control and automation of a building's Functions and/or Activities

In one embodiment traffic prediction algorithms are used for the creation of the spatial maps of zones of building 25. In one embodiment methods are used that can be grouped into 4 major categories: (i) partitioning methods, (ii) hierarchical methods, (iii) overlapping methods and (iv) ordination methods.

A plurality of building occupant scenarios at building 25 is simulated. In one embodiment two different clustering procedures are conducted: input-based clustering and output-based clustering. The input-based clustering is presented as building occupant activity clustering. In one embodiment output-based clustering uses the simulation output produced under the building occupant activities.

For the number of clusters, a criterion for choosing a reasonable K is adopted by examining final within-cluster sum of squares (WCSS) values J (K) as follows:

$$R = \frac{J(K) - J(K+1)}{J(K)} \times 100\%$$

$$J(K) = \min_s \sum_{i=1}^K D(S_i) = \min_s \sum_{i=1}^K \sum_{X_n \in S_i} \|X_n - \mu_i\|^2$$

$$\mu = \frac{\sum_{i=1}^n d_i t_i}{\sum_{i=1}^n d_i}$$

As illustrated in FIGS. 21(a)-(e) in one embodiment switch terminal 12 includes a front module 710, a radio module 712, a power module 714, locking mechanism 512 and a switch terminal back cover 716. The front module 710 includes a back cover 718. In one embodiment the back cover 718 is metal that can be utilized for improved wireless radio interface 20, e.g. radio performance.

The front module includes a pivot 720 and interface 20 which can be display 48, touchscreen 50 and the like, (hereafter "display screen 48". Display screen 48 pivots and provides that a pivot is at switch terminal 12. Display screen 48 allows a building occupant to interact with a switch terminal 12. The pivot 720 absorbs a load created by potential over application of force by a building occupant at switch 12. In one embodiment the pivot 720 is a type of suspension. It can be clicked on by a building occupant and also go beyond it. In one embodiment the pivot 720 is a mechanical pivot and terminal switch 12 can be grounded through the pivot 720. As a non-limiting example all metal elements of switch terminal 12 need to be grounded for radio performance. In one embodiment an element 722 is provided that causes the pivot to come back. In one embodiment the element 722 is a flat spring 722. In one embodiment the pivot 720 has a recess 724 that is a safety mechanism against damaging buttons 726 on a radio board 728 that is included in the radio module 712.

In one embodiment the back cover 718 of front module 710 is metal that can be utilized for improved radio perfor-

mance. In one embodiment the back cover **718** provides a thermal and RF shield for the processor **730** as well as other components at the front module **710**. The back cover **718** is part of the radio and activates the tactile buttons.

In one embodiment front module **710** includes processor **730** with processor board, memory and the one or more additional processor components **62** including but not limited to CPUs, GPUs, and DSPs. In one embodiment one or more additional platforms, provided by backend **17** and/or cloud **21**, are loaded locally onto the computing device **14** for local execution. This can be used to achieve additional functionality including but not limited to, matching learning, lighting related objectives, one or more networking technologies including but not limited to Wifi, Bluetooth, BLE and sub-GHz band; local and distributed protocols for establishing a communication system or method **64** between first and third party devices **18** or services with each other. As a non-limiting example a mesh network **64** can be used.

In one embodiment display screen **48** includes one or more cutouts for speaker **54**, an ambient light sensor **15**, motion detection sensor **15**, which can be motion detection sensor **410**, and a proximity sensor **15**, as well as any other sensors **15** that are typically located behind the display screen **48**. As a non-limiting example the motion detection sensor **15** can be a Fresnel lens in order to increase the field of view of motion detection sensor **15**. Fresnel lens can be a flat Fresnel lens. In one embodiment a lens can be provided to provide for a 180 degree view.

In one embodiment a spacer **732** is provided for isolation so the heat does not go to processor **730**. The spacer can be made of a suitable heat isolation material including but not limited to plastic and the like.

In one embodiment a back ring **734** is provided that serves as a heat sink for the mosfets that are provided for dimming, which can be coupled to the power management system **32**.

The metal of terminal switch **12** increases the RF signal exiting from terminal switch **12** and out of a wall of building **25**.

In one embodiment the radio module **712** includes the radio elements of FIGS. **14** and **15** including but not limited to radio **20** and antenna **210**. A yoke **736** of switch terminal **12** is included that can be a ground piece of metal and insures ground on the outside of switch terminal **12** and a radio board **728**. Mounted above the radio module **712** is the pivot **720** with one or more pivot elements **740** that are in communication with tactile buttons **56**. The elements press on the tactile buttons **56**. The tactile buttons **56** are at the radio board **728**.

In one embodiment a cable **740**, which can be a flex cable, is coupled to the front module **710** and the radio board **728**. LED **52**, voice recognition interfaces **58**. e.g. microphone, motion detection sensor **410**, ambient light sensor **15** and proximity sensor **15** are at the cable **740** that connects to radio board **728**. Speaker **54** and tactile buttons **56** are at the radio board **728**.

The radio board **728** board includes antenna **210**, which as previously recited can be dual-band slot antenna **210**. Antenna **210** is integrated and/or coupled to the electrical circuit **28**, which as a non-limiting example can be a printed circuit board **28**, of the computing device **14** which can include at least two radio circuits **218** and **220** to provide a network interface to switch terminal **12**. The radio board **728** of radio module **712** is a structural mechanical piece as well as having a slot antenna and the two radio components, the diplexer circuit **222** that allows the use of one antenna **210** for two radios **20**, for radio propagation, RF propagation,

while switch terminal **12** is in a metal junction box. All of the pieces of metal are ground and are part of the radio **20** performance and enhance radio, RF propagation. We then have the power module all of the high power electronics, this is where the wires where the wall go in. It is the custom junction.

Power module **714** includes the elements of power management system **32** as provided in FIG. **16**.

Back module **715** is adjacent to power module **714** and includes locking mechanism **512**.

Switch terminal back cover **716** is adjacent to back module **715**.

FIG. **22** illustrates one embodiment where one or more switch terminals **12** of a building **25** include a speech recognition system **800** for initiating communication based on identifying a voice command. As non-limiting examples speech recognition and an activity assistant, as more fully described hereafter, can run in one of the following configurations: wake word detection on one or more switch terminals **12** without assistance of the Network system, e.g., Network System and recognition of utterance in the cloud system **21**; wake word detection and recognition of utterance both in the cloud system **21**; wake word recognition and limited speech recognition on a device **18** without Network system with expanded utterance recognition in the cloud system **21** if available; and completely on one or more devices **18** without the assistance of the Network system for both wake word recognition and utterance recognition. As non-limiting examples for all of the previous combination there can be a plurality of recognizers and assistants simultaneously. First and third parties can simultaneously operate at building **25** where at least two of the available services are using a different configuration for wake word detection and utterance recognition in terms of its utilization of a device **18** only or cloud system **21** assisted operation.

In one embodiment the commands are sent from switch terminal **12** to a server, e.g., which can be a cloud system **21** server. In one embodiment switch terminal **12** and server is in communication with a contact name database **806** coupled to the cloud system **21** based server. In one embodiment the server is coupled to an automatic speech recognizer (ASR) **810**, a parser **812**, which can be at one or more switch terminals and/or parsing at cloud system by a first, second and/or third party, a rules database **814**, and a communication engine **816**. The server computing system **804** is in communication with switch terminal **12** over Network Systems. Any server discussed herein can be replaced by one or more of: computer **14**, an individual switch terminal **12**, a switch terminal system (multiple switches **12** working together), a combination of distributed microphones and speakers using one or more switch terminals **12** as a central processing node for wake word detection, speech recognition, transference to the cloud system **21**, and the like, for further operation.

In one embodiment switch terminal **12** receives one or more commands by the building occupant, such as those set forth above.

In one embodiment the switch terminal **12** transmits audio data, e.g., the waveform data **820**, corresponds to the utterance **818** to the ASR **21610**. For example, the switch terminal **12** provides audio data corresponding to the utterance **818** of the information requested by the command to the ASR **810** over Network System.

In some embodiments, the ASR **810** receives the audio data, e.g., the waveform data **820**, corresponding to the utterance **818** from the one or more switch terminals **12**. As a non-limiting example, the ASR **810** receives the audio data

corresponding to the utterance **818** of the information requested from the command.

In one embodiment, ASR **810** obtains a transcription of the utterance **818** using a first language model. As a non-limiting example ASR **810** processes the utterance **818** by applying the utterance **818** to a first language model **824** to generate a transcription **822** of the utterance **818**. In one embodiment the first language model **824** is a “general” or “generic” language model trained on one or more natural languages, e.g., the first language model **824** is not specific to the building occupant **808**, but is utilized by a general population of building occupants accessing the server computing system **804**.

In one embodiment the ASR **810** applies the utterance **818** of the information from the requested command to the first language model **824** to generate the transcription **822** of the command

In one embodiment the ASR **810** provides the transcription **822** to the parser **812**. In one embodiment the parser **812** determines that the transcription **822** of the utterance **818** probably includes a voice command.

In one embodiment the parser **812** uses the rules database **814** in determining whether the transcription **822** of the utterance **818** includes a voice command, or is associated with a voice command. In one embodiment the parser **812** compares some or all of the transcription **822** of the utterance **818** to the rules of the rules database **814**. In response to comparing the transcription **822** of the utterance **818** to the rules of the rules database **814**, the parser **812** determines whether the transcription **822** of the utterance **818** satisfies at least one rule of the rules database **814**, or matches a text pattern associated with a rule.

In one embodiment, the server computing system **804** can transmit a portion of the received audio data to one or more switch terminals **12**. As a non-limiting example the server computing system **804** extracts a portion of the received audio data as a waveform **826**.

In one embodiment in response to receiving the indication **824** from the server computing system **804**, the switch terminal **12** applies a representation of the audio data corresponding to the utterance, e.g., the waveform **826**, to a different, second language model. In the illustrated example, in response to receiving the indication **824**, the switch terminal **12** applies the waveform **826** to the different, second language model to identify data **828** that references a contact. In one embodiment switch terminal **12** applies the waveform **826** to the different, second language model to obtain a transcription of the utterance **818** that corresponds to the waveform **826**.

By applying the waveform **826** to a language model, the switch terminal **12** identifies data **828** that references a contact that is associated with the building occupant **808**. As a non-limiting example switch terminal **12** processes the waveform **826** according to the second, different language model to identify the data **828** referencing a contact. As a non-limiting example the switch terminal **12** is in communication with a contact name database **806**. The switch terminal **12** determines that the waveform **826** “matches,” based on the different, second language model, at least one of the contact names stored by the contact name database **806**. As a non-limiting example the contact name database **806** stores mappings between contact names and an output of the language model.

In one embodiment based on the transcription of the information retrieved from the command that corresponds to the waveform **826**, the switch terminal **12** identifies a mapping stored by the contact name database **806** between

the transcription of a command and the data **828**. As a non-limiting example in the event of a command to call somebody the data **828** of a phone number associated with that person is identified.

In one embodiment switch terminal **12** transmits the data **828** referencing the contact to the server **104**, e.g., over Network Systems.

In one embodiment a server computing device **802**, and specifically, the parser **812**, receives the data **828** referencing the contact. As a non-limiting example the parser **812** receives the phone number that is associated with the contact corresponding to building occupant’s command.

In one embodiment the parser **812** causes the voice command to be performed using the data **828** referencing the contact. As a non-limiting example the parser **812** generates an instruction **830** that is transmitted to communication engine **816**. The communication engine **816** causes the voice command to be performed. As a non-limiting example the voice command is performed by switch terminal **12** the server computing system **804**, or a combination of both. In one embodiment the instruction is further based on a portion of a transcription **822** of the utterance **818** and the data **828** referencing the contact.

Referring now to FIG. **23** a speech recognition system **910** receives verbal search terms from a command and uses a language model to access the updated entries for the word and recognize the associated text. In one embodiment a cloud system **21** based search server **908** retrieves the requested data relative to the information requested by the building occupant based on the search terms that have been translated from verbal search terms to text, collects the search results **914**, and transmits the search results, which as a non-limiting example can be one or more switch terminals. In one embodiment one or more switch terminals **12** can play a voice, which can be synthesized, through an audio speaker that speaks the results to the building occupant.

In one embodiment one or more switch terminals **12**, in FIG. **23**, can have networking capabilities and is shown sending textual search terms (commands) **916** to the search server **908**. The entered textual search terms, which may include one or more portions of sound, can be added to an available dictionary terms for speech recognition system **910**.

As a non-limiting example a probability value may be assigned to the complete terms or the portions of sound based on a chronological receipt of the terms or sounds by the search server **908** or number of times the terms are received by search server **908**. Popular search terms may be assigned higher probabilities of occurrence and assigned more prominence for a particular time period. In addition, the search may also return data to the device **18** to update probabilities for the concurrence of the words. In particular, other terms associated with a search can have their probabilities increased if the terms themselves already exist in the dictionary. Also, they may be added to the dictionary when they otherwise would not have been in the dictionary. Additionally, a dictionary entry may be changed independently of the others and may have separate probabilities associated with the occurrence of each word.

As non-limiting examples speech recognition system **910** can utilize language models (grammar) and acoustic models. In one embodiment language models may be rule-based, statistical models, or both. As a non-limiting example a rule based language model has a set of explicit rules describing a limited set of word strings that a building occupant is likely to say in a defined context.

In one embodiment a statistical language model is utilized that is not limited to a predefined set of word strings, and instead represents what word strings occur in a more variable language setting. As a non-limiting example a search entry can be variable because any number of words or phrases may be entered. As a non-limiting example a statistical model uses probabilities associated with the words and phrases to determine which words and phrases are more likely to have been spoken. The probabilities may be constructed using a training set of data to generate probabilities for word occurrence. The larger and more representative the training data set, the more likely it will predict new data, thereby providing more accurate recognition of verbal input.

Language models may also assign categories, or meanings, to strings of words in order to simplify word recognition tasks. For example, a language model may use slot-filling to create a language model that organizes words into slots based on categories. The term "slot" refers to the specific category, or meaning, to which a term or phrase belongs. The system has a slot for each meaningful item of information and attempts to "fill" values from an inputted string of words into the slots. For example, in a travel application, slots could consist of origin, destination, date or time. Incoming information that can be associated with a particular slot could be put into that slot. For example, the slots may indicate that a destination and a date exist.

In one embodiment acoustic models represent the expected sounds associated with the phonemes and words a recognition system must identify. A phoneme is the smallest unit a sound can be broken into, e.g., the sounds "d" and "t" in the words "bid" and "bit." Acoustic models can be used to transcribe uncaptioned video or to recognize spoken queries. It may be challenging to transcribe uncaptioned video or spoken queries because of the limitations of current acoustic models. For instance, this may be because new spoken words and phrases are not in the acoustic language model and also because of the challenging nature of broadcast speech (e.g., possible background music or sounds, spontaneous speech on wide-ranging topics).

Referring to FIG. 24 one embodiment of a search server 1001 using a speech recognition system 1032 is shown to identify, update and distribute information for a data entry dictionary according to one implementation. System 1000 can be one implementation of system 900 shown in FIG. 23. In one embodiment system 1000 is implemented as part of a Network System search provider's general system. The system 1000 can be equipped to obtain information about the occurrence and concurrence of terms from various sources. In one embodiment system 1000 also obtains information about the pronunciation of words and phonemes, which include one or more portions of sound, from verbal input associated with textual input. Both types of obtained information are used to generate dictionary information. Such sources could include, for example, audio or transcript data received from a television transmitter, data related to an individual (such as outgoing messages stored in a Sent Items box), data entered verbally or textually into a wireless communication device, or data about search terms entered recently by building occupants of a Network system search service.

The system 1000 can include an interface 1002 to allow communications in a variety of ways. In one embodiment interface 1001 can be switch interface 20 or any other type of interface connected to system 10, including but not limited to one or more speakers or groups of speakers, display screen 48, speaker 54 and/or a speaker group 54, or a screen of some kind.

Commands and requests received from one or more switch terminals 12 may be provided to request processor 1012 such as processor 730, which may interpret a request, associate it with predefined acceptable requests, and pass it on, such as in the form of a command to another component of search server system 1000 to perform a particular action. As a non-limiting example, where the request includes a search request, the request processor 1012 may cause a search engine 1014 to generate search results corresponding to the search request. In one embodiment search engine 1014 can use data retrieval and search techniques like those used by the Google PageRank™ system. The results generated by the search engine client 1014 can be provided back to the original requester using a response formatter 1016. The response formatter 1016 carries out necessary formatting on the results.

An NPL engine, voice application intended to provide a response to interpreted utterances, first, second and third party voice services and a search engine 1014 can use a number of other components for its operation. As a non-limiting example the search engine 1014 can refer to an index 1018 of web sites instead of searching the web sites themselves each time a request is made, so as to make the searching much more efficient.

The index 1018 can be populated using information collected and formatted by a web crawler 1020, which may continuously scan potential information sources for changing information. Search engine 1014 may also use a synchronizer 1021 to ensure received data updates system 1000 with the latest language model available.

In addition to search results, system 1000 can use the dictionary generator system 1044 to provide building occupants with updated dictionary information, which may include building occupant-specific information. As a non-limiting example updater system 1044 can operate by extracting relevant concurrence data or information from previous search terms, generating occurrence data for the information, and organizing the information in a manner that can be transmitted to a remote device 18.

In one embodiment dictionary generator 1022 uses the components in FIG. 24. As a non-limiting example this can include a training set 1024, weightings 1026, and a test set 1028. In one embodiment the training set 1024 is a set of audio recordings and associated transcripts used to generate pronunciation and sound entries in a pronunciation dictionary 1072 and a phoneme dictionary 1070, respectively. Audio recordings can be associated or synched with the associated transcript text using a synchronizer 1021, and the dictionary generator 1022 can create preliminary dictionary entries based on the synchronized audio recordings and transcripts. In one embodiment, the sounds that are extracted from an audio recording correspond to one or more letters from the transcript that is associated and synchronized with the audio recording. The dictionary generator 1022 uses these extracted components to generate the dictionary entries.

In one embodiment, the weightings include factors, or coefficients, that indicate when the voice recognition system 1000 received a word associated with the weightings. The factors can cause the voice recognition system 1000 to favor words that were received more recently over words that were received in the past. As a non-limiting example the dictionary generator 1022 can access system storage 1030 as necessary. In one embodiment system storage 1030 can be one or more storage locations for files needed to operate voice recognition system 1000.

In one embodiment speech recognition system **1000** uses an extractor to analyze word counts **1042** from the entered search term(s) and an updater **1044** with dictionary **1046** and grammar systems **1048** to access the current speech recognition model **1049**. In one embodiment speech recognition model **1049** can use a recognizer **1050** to interpret verbal search terms.

In one embodiment, the recognizer **1050** determines a context for the verbal search terms

In one embodiment illustrated in FIG. **25** exemplary steps are used for adding data to a speech recognition system. The chart shows an embodiment in which a system updates a statistical speech recognition model based on building occupant entered terms. The building occupant entered terms may be accepted into the system as they are entered, or the terms may already reside in system storage. At step **1102**, search terms may be received wirelessly or accessed from system storage. The search terms may be textual input or verbal input. At step **1104**, the baseline speech recognition model is accessed to determine the existence of the search terms in the current dictionary. In step **1106**, the system obtains information from previous search queries in an attempt to find a match for the search terms entered. The system may determine to split the terms and continue analysis separately for each entered term or the system may determine multiple strings of terms belong together and continue to step **1107** with all terms intact.

In step **1107**, four optional steps are introduced. Optional step **1108** may assign a weighting value to the term(s) based on receipt time into the system. Optional step **1110** may modify existing dictionary occurrence data based on the new information entered. Optional step **1112** may assign a sub-grammar to the new information. Optional step **1114** may modify existing dictionary concurrence data based on the new information entered. One, all, or none of steps **1108**, **1110**, **1112** and **1114** could be executed.

Once the search terms have been analyzed for occurrence, existence and weightings, step **1116** verifies no further search terms remain. If more search terms exist, the process begins again in step **1102**. If a certain number of search terms have not been received, the system continues to analyze the entered search term(s). Alternatively, the system may continually update the dictionary entries.

The speech recognition system determines whether or not the data is a verbal search term in step **1118** or a verbal system command in step **1120**.

In one embodiment switch terminal **12** may receive the terms and transfer them to a speech recognition system. The speech recognition system may decide this is a system command and associate the verbal command with a text command on the switch terminal **12** as shown in step **1120**. In the example above, the speech recognition system would allow a switch terminal **12** to make the phone call to "Cameron," where the translated verbal search term is associated with a telephone number, thereby executing the call command in step **1122**. However, the speech recognition system may determine the received verbal term is a search and attempt to associate the verbal search term with a text search term as shown in step **1118**. If the entry "call Cameron" is determined not to be a system command, the speech recognition system attempts to match the term with using dictionary entries derived from daily news broadcasts and text search terms.

In one embodiment once a textual term is associated with the spoken verbal search, the text term may be transmitted to the search server **201**. The search server **201** may generate search results using the text search term, and, the results are

returned to the switch terminal **12** in step **1126**. The system checks for additional verbal search terms in step **1128**. If no further system commands or search terms exist, the processing for the entered data ends.

In one embodiment, illustrated in FIG. **26**, exemplary steps are utilized for adding data to a pronunciation model. The data for updating acoustic models may include captioned video. The data may be used to update acoustic models used for spoken search queries since new or current words previously not in the acoustic model are often provided from new captioned video broadcasts. The flow chart shows an embodiment in which a system updates a pronunciation model based on received audio or transcript information.

In step **1202**, audio or transcript information is received wirelessly or accessed from system storage, which can be one or more switch terminals **12**. The information may be textual input, audio input, video input, or any combination thereof. In step **1204**, synchronizing the audio and transcript information is performed. This ensures the audio information "matches" the associated transcript for the audio. Any piece of audio information or transcript information may be divided into training and test data for the system. The training data is analyzed to generate probability values for the acoustic model. As shown in step **1208**, this analysis may include extracting letters to associate pronunciation of words. A weighting system is introduced to appropriately balance the new data with the old data. In step **1210**, the associations between letters and pronunciations are weighted.

In step **1212**, verification is performed on the test set to determine if weightings optimize recognition accuracy on the test set. The system may associate several weights with the corresponding preliminary dictionary entry in an attempt to maximize recognition accuracy when the dictionary entries are accessed to interpret the test set of audio recordings. The system then selects the weighting that optimizes recognition accuracy on the test set. If the weightings optimize recognition accuracy on the test set, a dictionary entry can be generated in step **1214**. If the weights cannot optimize recognition, step **1210** is repeated. When a dictionary term is generated, switch terminal **12** executes, in step **1216**, operations to determine if more audio transcripts are available. If more audio or transcripts exist, the process returns to step **1202**. If no more audio or transcript information is available, the process terminates.

For purposes of the present invention and "activity", can be anything discloses above, as well as a data construct describing a thing to do, which a building occupant can associate with a building occupant's "activity-assistant account." In an example embodiment, an activity is defined at least in part by one or more singular, global activity parameters. For example, global parameters for a given activity may include: (a) a title or text description (e.g., "get brunch at Boogaloo's restaurant"), (b) data indicating the location that is associated with the activity (e.g., the latitude/longitude and/or the address of Boogaloo's restaurant), (c) data indicating one or more building occupant "moods" that may be indicative of the activity being more or less well-suited for a given building occupant (e.g., "fun", "social", "cerebral", "productive", "ambitious", etc.), (d) data indicating time constraints on the activity (e.g., the hours Boogaloo's restaurant is open and/or the hours during which Boogaloo's restaurant serves brunch), and/or (e) any other data that may be directly or indirectly interpreted to affect the importance of a given activity to a given building

occupant. Further, an activity can be doable at multiple locations (e.g., “Eat a hamburger” or “Go river rafting”).

Generally, an activity is a building occupant-defined construct, and thus the global parameters that define each activity may vary. In particular, a given activity may or may not include all of the above-mentioned global activity parameters. For example, a building occupant may create an activity that is not tied to any particular location (e.g., “do homework for math class”), and thus choose not to provide a location. Furthermore, as activities are flexible and dynamic constructs, it should be understood that the above-mentioned examples of global parameters are not limiting. It is also possible that an activity may be generated by a computing system without any initial building occupant input (or alternatively, generated based on some building occupant-provided input).

Once an activity is created, however, its global parameters apply to all building occupants who add the activity. Thus, in effect, there is a single copy of each activity and its global parameters that is common all building occupants that have access to the activity. It should be understood, however, that global parameters can still be flexible and dynamic; changing over time in relation to the activity. For example, a “popularity” parameter may be defined for an activity that is updated on an ongoing basis to reflect the number of building occupants that have added the activity.

To further allow for customization of activities to a particular building occupant, “building occupant-specific” parameters, which vary between building occupants, may be defined for an activity. Accordingly, while the global parameters of an activity are the same for all building occupants, each building occupant that adds an activity may customize their building occupant-specific parameters for the activity. For instance, building occupant-specific parameters may be used to specify: (a) plans regarding the activity (e.g., “I want to do it”, “I want to do it again, but not for a few weeks,” “I must do it before December 25,” “I never want to do it again,” etc.), (b) the building occupant’s history regarding that scheme (e.g., I went there with Lauren on November 4 and again with Ryan on November 28), (c) personal time constraints based on building occupant preferences (e.g., preference of brunch early on Sunday so she has time to digest before her yoga class at noon or preference of brunch around noon because he usually stays out late on the weekends), and/or (d) any other personal preferences related to, and “overrides” or modifications of, the global parameters (e.g., “I like to go to Boogaloo’s restaurant when I’m depressed because it cheers me up,” “I like to go to Boogaloo’s restaurant when I have friends in town,” etc.).

In a further aspect, an activity may be designated as a “public” or “private” activity. Depending on how a given activity is defined, this designation may be made by setting a global parameter when the activity is created (and thus apply to all building occupants who add the activity), and/or may be made via a building occupant-specific parameter that is settable by each building occupant who adds an activity.

An activity that is designated as “public” via a global parameter may be viewable (and thus addable) to all building occupants, whereas an activity that is designated as “private” via a global parameter may only be viewable to the creator of the activity. In an example embodiment, a global parameter may be set to designate an activity as a “private shared” activity, in which case the activity may only be viewable by the author and the building occupants the author specifies. Further, the fact that a given activity is designated as “public,” “private,” or “private shared” via a global

parameter may be interpreted as a signal relevant to the importance of the activity to a certain building occupant.

When an activity is designated as “private” via a building occupant-specific parameter, other building occupants are generally not notified that the building occupant has added the activity. And when an activity is designated as “public” via a building occupant-specific parameter, other building occupants may be notified and/or is able to see that the building occupant has added the activity. Further, when an activity is designated as “public” via a building occupant-specific parameter, the building occupant may be able to define which other building occupants can view and/or which other building occupants should be notified that they have added the activity.

In one example embodiment, an “activity assistant”, and/or activity system, is provided, which is configured to evaluate the relative importance of activities to a particular building occupant so that activities can be presented on the activity assistant building occupant interface in a logical manner. In particular, the activity assistant may score an activity based not only on the characteristics of the activity itself, but also based on data that is indicative of the building occupant’s “context” (e.g., the building occupant’s, interests, intents, moods, experiences, associations with other building occupants, etc.). With the support of the activity assistant, the activity assistant building occupant interface may therefore provide building occupants with a dynamic and flexible mechanism for deciding what activities they might enjoy, and how they would like to spend their time.

In order to quantify the importance of a particular activity for a particular building occupant, the activity assistant may identify and/or determine any number of “signals” that may be directly or indirectly relevant to the importance of an activity to the particular building occupant. From the perspective of the activity assistant, signals may take the form of information provided by global parameters and building occupant-specific parameters taken individually or information determined by evaluating interactions between global parameters, building occupant-specific parameters, and/or other data sources. The activity assistant may evaluate the signals for a particular building occupant in combination with a particular activity, the activity assistant may quantify the importance of the particular activity for the particular building occupant (e.g., by assigning a “score” to the activity).

As non-limiting examples the signals may include but are not limited to: (a) the level of similarity between building occupant’s mood and activity mood, (b) the level of similarity between the building occupant’s context (as indicated by building occupant-specific signals and/or building occupant-specific parameters indicating, for example, whether the building occupant is on a desktop computer/mobile phone, on-line/off-line, talking on the phone, driving, walking, etc.) and corresponding activity context requirements and/or restrictions (as indicated by global parameters of the activity), (c) distance between building occupant’s location and activity location (if available), (d) appropriateness of current weather at building occupant’s location and/or activity’s location for the activity (e.g., rainy, sunny, snowy, etc.), (e) building occupant-designated priority for the activity, (f) building occupant-designated due date (or next due date, if recurring), (f) snooze history or pattern for the activity, (g) amount of time required for the activity, (h) progress or status of the activity (done, active, in-progress, etc.), (i) ownership of the activity (e.g., whether the owner is the particular building occupant in question or another building occupant), (j) whether the building occupant

received a heads-up, (k) popularity of the activity (e.g., number of comments on an activity, or the number of people who have commented, copied, liked, shared, done, or followed the activity), (l) similarity between building occupant query string and activity text (for search/suggest), (m) similarity between building occupant query string and names or e-mails of other building occupants in the activity (for search/suggest), (n) similarity between building occupant query string and activity comment text (for search/suggest), and (o) whether the building occupant indicated another building occupant with whom to participate in the activity with.

Supported with this intelligence from the activity assistant, the activity assistant building occupant interface may present activities that a particular building occupant has associated with their account in a logical order that is based at least in part upon the relative importance of the activities to the building occupant. In particular, the activity assistant may evaluate the signals for each activity in a building occupant's activity list (e.g., each activity that has been added by the building occupant) and assign a score to the activity. The activity assistant can then rank the activities in the building occupant's activity list according to their respectively determined score, and relay this information to the activity assistant building occupant interface so that it can adjust the displayed activity list accordingly.

Further, the intelligence of the activity assistant may be utilized to provide "suggested" activities that are tailored to the particular building occupant's preferences, tendencies, location, time table, associated other building occupants, and/or mood at a given point in time. In particular, the activity assistant may initiate an activity search that takes into account the scores of activities when ranking the search results, and these search results may be presented to the building occupant via the activity assistant building occupant interface. In a similar manner, the activity assistant may support an "activity search" feature of the activity assistant building occupant interface. This feature may allow the building occupant to enter text and initiate an activity search on the text, the results of which factor in the relative scores of activities as assessed by the activity assistant.

In some examples, when a certain available activity exceeds a certain relevance threshold for a building occupant's current context, the activity assistant sends a "push" notification (or "alert") to a given building occupant's computing device **14** or a mobile device. By way of example, the building occupant has indicated that the building occupant needs to buy a mother's day present via a given activity, the building occupant is passing a location where this activity can be done, and the current date is the day before mother's day. This example would utilize the scoring function as in the above described activity list, but an activity would have to pass a higher threshold in order to generate a notification.

According to an example embodiment, a building occupant interface is provided that allows for intuitive building occupant interaction with such activities. This building occupant interface may be generally referred to herein as an "activity assistant building occupant interface." A building occupant typically accesses the activity assistant building occupant interface by logging in to a building occupant's activity-assistant account. According to an example embodiment, the activity assistant building occupant interface displays graphical representations of activities to a building occupant in a logical manner that varies according to the interests, intents, associations with other building occupants, and moods of the building occupant. Via the activity assis-

tant building occupant interface, the building occupant may view activities they have added to a personal "activity list," view suggested activities, create and add new activities to their activity list, and/or add/delete existing activities (e.g., those created by other building occupants) to/from their activity list, among other functions.

Turning to the figures, FIG. **51** illustrates one embodiment of an activity assistant network ("network"). In one embodiment network **1300**, activity assistant server **1308** and possibly activity content server **1302** are configured to communicate, via a network **1306**, with client devices **1304 a**, **1304 b**, and **1304 c**. As shown in FIG. **51**, client devices can include a personal computer **1304 a**, a telephone **1304 b**, and a smart-phone **1304 c**. More generally, the client devices **1304 a**, **1304 b**, and **1304 c** (or any additional client devices) can be any sort of computing device, such as an ordinary laptop computer, desktop computer, network terminal, wireless communication device (e.g., a cell phone or smart phone), and so on.

The network **1306** is Network System, as defined above, which can correspond to a local area network, a wide area network, a corporate intranet, the public Network system, combinations thereof, or any other type of network(s) configured to provide communication between networked computing devices. Activity content server **1302** can provide content to client device **1304 a-1304 c** and/or activity assistant server **1308**. The content can include, but is not limited to, web pages, hypertext, scripts, binary data such as compiled software, images, audio, and/or video. The content can include compressed and/or uncompressed content and/or encrypted and/or unencrypted content. Other types of content are possible as well.

In an alternative arrangement, activity assistant server **1308**, one or more computers **14** at one or more switch terminals, and activity content server **1302** can be co-located and/or combined as a common server. Further, it is also possible that activity assistant server **1308** and/or activity content server **1302** can be accessible via a network separate from the network **1306**. Yet further, although FIG. **51** only shows three client devices, activity assistant server **1308** and/or activity content server **1302** can serve any number of client devices (from a single client device to hundreds, thousands, or even more client devices).

Global activity database **1312** typically includes activity data that defines a plurality of activities. In particular, the activity data for each activity may include one or more global activity parameters that collectively define the global context for the activity. Further, building occupant-account database **1310** may include data for building occupants' activity accounts. This data may include, for a given one of the accounts, data indicating building occupant-specific parameters and signals. Further, for a given activity account, the data may include an indication of which activities, if any, are associated with the account (e.g., the activities that a building occupant has added to their activity list).

According to an example embodiment, activity assistant server **1308** embodies the "activity assistant" and thus is configured to provide the activity-assistant functionality described herein. In particular, activity assistant server **1308** may be configured to identify signals relating to the importance of a particular activity to a particular building occupant (e.g., relating to a given building occupant-activity pair), so that activities can be logically displayed to a building occupant, suggested to a building occupant, and/or searched for a building occupant via an activity assistant building occupant interface.

In some embodiments, activity-assistant functionality described herein may also be performed by software on the device such as, but not limited to, devices **1304 a**, **1304 b**, and **1304 c** as shown in FIG. 27. For example, the client software running on the device such as, but not limited to, devices **1304 a**, **1304 b**, and **1304 c** as shown in FIG. 27 may perform all or some portion of the ranking functionality and/or provide more advanced assistance, e.g. by providing a latitude/longitude and/or map for an address entered by the building occupant via an activity assistant building occupant interface and/or by directly communicating with an activity assistant processing system.

In one embodiment the signals come from system **10**, including but not limited to one or more switch terminals **12** as well as from elements not included in system **10**. In one embodiment the activity assistant server **1308** may acquire the data from which signals are determined, and/or data directly providing signals, from a number of different data sources. For example, activity content server **1302** may provide activity assistant server **1308** with access to global activity database **1312** and building occupant-account database **1310**. Thus, when evaluating the importance of a particular activity to a particular building occupant, activity assistant server **1308** may retrieve the global parameters of the activity from global activity database **1312**, as well as building occupant-specific parameters from building occupant-account database **110**.

As a non-limiting example, FIG. 28(a) is a block diagram of a computing device in accordance with an example embodiment. Computing device **1400** can be configured to perform one or more functions of client devices **1304 a**, **1304 b**, and **1304 c**, activity assistant server **1308**, and/or activity content server **1302**. The computing device **1400** can include a building occupant interface system **1401**, a network-communication interface system **1402**, and one or more processors **1403**, and/or data storage **1404**, all of which can be linked together via a system bus, network, or other connection mechanism **1405**. Data storage **1404** can be at one or more switch terminals **12**, one or more devices **18**, cloud system **21** and the like.

The building occupant interface system **1401** can be operable to send data to and/or receive data from external building occupant input/output devices. For example, the building occupant interface system **1401** can be configured to send/receive data to/from building occupant input devices such as a keyboard, a keypad, a touch screen, a computer mouse, a track ball, a joystick, a microphone, and/or other similar devices, now known or later developed. The building occupant interface system **1401** can also be configured to provide output to building occupant display devices, such as one or more cathode ray tubes (CRT), liquid crystal displays (LCD), light emitting diodes (LEDs), displays using digital light processing (DLP) technology, printers, light bulbs, and/or other similar devices, now known or later developed. The building occupant interface system **1401** can also be configured to receive audible input(s) via the microphone (or similar audio input device) and/or generate audible output(s), such as a speaker, speaker jack, audio output port, audio output device, earphones, and/or other similar devices, now known or later developed.

The network-communications interface system **1402** can include one or more wireless interfaces **1407** and/or wireline interfaces **1408** that are configurable to communicate via Network System, such as the network **1306** shown in FIG. 41. The wireless interfaces **1407** can include one or more wireless transceivers, such as a Bluetooth transceiver, a Wi-Fi transceiver perhaps operating in accordance with an

IEEE 802.11 standard (e.g., 802.11a, 802.11b, and 802.11g), and a WiMAX transceiver perhaps operating in accordance with IEEE 802.16 standard, and/or other types of wireless transceivers configurable to communicate via a wireless network. The wireline interfaces **1408** can include one or more wireline transceivers, such as an Ethernet transceiver, a Universal Serial Bus (USB) transceiver, or similar transceiver configurable to communicate via a wire, a twisted pair of wires, a coaxial cable, an optical link, a fiber-optic link, or other physical connection to a wireline network.

In some embodiments, the network communications interface system **1402** can be configured to provide reliable, secured, compressed, and/or authenticated communications. For each communication described herein, information for ensuring reliable communications (e.g., guaranteed message delivery) can be provided, perhaps as part of a message header and/or footer (e.g., packet/message sequencing information, encapsulation header(s) and/or footer(s), size/time information, and transmission verification information such as cyclic redundancy check (CRC) and/or parity check values). Communications can be compressed and decompressed using one or more compression and/or decompression algorithms and/or protocols such as, but not limited to, one or more lossless data compression algorithms and/or one or more lossy data compression algorithms. Communications can be made secure (e.g., be encoded or encrypted) and/or decrypted/decoded using one or more cryptographic protocols and/or algorithms, such as, but not limited to, DES, AES, RSA, Diffie-Hellman, and/or DSA. Other cryptographic protocols and/or algorithms can be used as well or in addition to those listed herein to secure (and then decrypt/decode) communications.

The one or more processors **1403** can include one or more general purpose processors and/or one or more special purpose processors (e.g., digital signal processors, application specific integrated circuits, etc.). The one or more processors **1403** can be configured to execute computer-readable program instructions **1406** that are contained in the data storage **1404** and/or other instructions as described herein.

The data storage **1404** can include one or more computer-readable storage media that can be read or accessed by at least one of the processors **1403**. The one or more computer-readable storage media can include volatile and/or non-volatile storage components, such as optical, magnetic, organic or other memory or disc storage, which can be integrated in whole or in part with at least one of the one or more processors **1403**. In some embodiments, the data storage **1404** can be implemented using a single physical device (e.g., one optical, magnetic, organic or other memory or disc storage unit), while in other embodiments, the data storage **1404** can be implemented using two or more physical devices.

Computer-readable storage media associated with data storage **1404** and/or other computer-readable media described herein can also include non-transitory computer-readable media such as computer-readable media that stores data for short periods of time like register memory, processor cache, and random access memory (RAM). Computer-readable storage media associated with data storage **1404** and/or other computer-readable media described herein can also include non-transitory computer readable media that stores program code and/or data for longer periods of time, such as secondary or persistent long term storage, like read only memory (ROM), optical or magnetic disks, compact-disc read only memory (CD-ROM), for example. Computer-readable storage media associated with data storage **1404**

and/or other computer-readable media described herein can also be any other volatile or non-volatile storage systems. Computer-readable storage media associated with data storage **1404** and/or other computer-readable media described herein can be considered computer readable storage media for example, or a tangible storage device.

The data storage **1404** can include computer-readable program instructions **1406** and perhaps additional data. In some embodiments, the data storage **1404** can additionally include storage required to perform at least part of the herein-described techniques, methods (e.g., methods **700** and **800**), and/or at least part of the functionality of the herein-described devices and networks.

FIG. **28B** depicts a network with computing clusters in accordance with an example embodiment. In FIG. **28B**, functions of activity assistant server **108** and/or activity content server **1310** can be distributed among three computing clusters **1409 a**, **1409 b**, and **1408 c**. The computing cluster **1409 a** can include one or more computing devices **1400 a**, cluster storage arrays **1410 a**, and cluster routers **1411** that can be included in system **10**, and a connected by local cluster network **1412 a**. Similarly, computing cluster **1409 b** can include one or more computing devices **1400 b**, cluster storage arrays **1410 b**, and cluster routers **1411 b** connected by local cluster network **1412 b**. Likewise, computing cluster **1409 c** can include one or more computing devices **1400 c**, cluster storage arrays **1410 c**, and cluster routers **1411c** connected by a local cluster network **1412 c**.

In some embodiments, each of computing clusters **1409 a**, **1409 b**, and **1409 c** can have an equal number of computing devices, an equal number of cluster storage arrays, and an equal number of cluster routers. In other embodiments, however, some or all of computing clusters **1409 a**, **1409 b**, and **1409 c** can have different numbers of computing devices, different numbers of cluster storage arrays, and/or different numbers of cluster routers. The number of computing devices, cluster storage arrays, and cluster routers in each computing cluster can depend on the computing task or tasks assigned to each computing cluster.

In computing cluster **1409 a**, for example, computing devices **1400 a** can be configured to perform various computing tasks of activity content server **1302**. In one embodiment, the various functionalities of activity content server **1302** can be distributed among one or more of the computing devices **1400 a**. For example, some of these computing devices can be configured to provide part or all of a first set of content while the remaining computing devices can provide part or all of a second set of content. Still other computing devices of the computing cluster **1409 a** can be configured to communicate with activity assistant server **108**. Computing devices **1400 b** and **1400 c** in computing clusters **1409 b** and **1409 c** can be configured the same or similarly to the computing devices **1400 a** in computing cluster **1409 a**.

As non-limiting examples, computing devices **1400 a**, **1400 b**, and **1400 c** each can be configured to perform different functions. For example, computing devices **1400 a** and **1400 b** can be configured to perform one or more functions of activity content server **1302**, and the computing devices **1400 c** can be configured to perform one or more functions of activity assistant server **1308**.

As non-limiting examples, cluster storage arrays **1410 a**, **1410 b**, and **1410 c** of computing clusters **1409 a**, **1409 b**, and **1409 c** can be data storage arrays that include disk array controllers configured to manage read and write access to groups of hard disk drives. The disk array controllers, alone or in conjunction with their respective computing devices,

can also be configured to manage backup or redundant copies of the data stored in the cluster storage arrays to protect against disk drive or other cluster storage array failures and/or network failures that prevent one or more computing devices from accessing one or more cluster storage arrays.

Similar to the manner in which the functions of activity assistant server **108** and/or activity content server **1302** can be distributed across computing devices **1400 a**, **1400 b**, and **1400 c** of respective computing clusters **1409 a**, **1409 b**, and **1409 c**, various active portions and/or backup/redundant portions of these components can be distributed across cluster storage arrays **1410 a**, **1410 b**, and **1410 c**. For example, some cluster storage arrays can be configured to store data for activity assistant server **1308**, while other cluster storage arrays can store data for activity content server **1302**. Additionally, some cluster storage arrays can be configured to store backup versions of data stored in other cluster storage arrays.

In one embodiment the cluster routers **1411 a**, **1411 b**, and **1411 c** in the computing clusters **1409 a**, **1409 b**, and **1409 c** can include networking equipment configured to provide internal and external communications for the computing clusters. For example, the cluster routers **1411 a** in the computing cluster **1409 a** can include one or more Network system switching and/or routing devices configured to provide (i) local area network communications between the computing devices **200 a** and the cluster storage arrays **1401 a** via the local cluster network **1412 a**, and/or (ii) wide area network communications between the computing cluster **1409 a** and the computing clusters **1409 b** and **1409 c** via the wide area network connection **1413 a** to the network **1306**. The cluster routers **1411 b** and **1411 c** can include network equipment similar to the cluster routers **1411 a**, and the cluster routers **1411 b** and **1411 c** can perform similar networking functions for the computing clusters **1409 b** and **1409 c** that the cluster routers **1411 a** perform for the computing cluster **1409 a**.

In some embodiments, computing tasks and stored data associated with activity assistant server **108** and/or activity content server **1302** can be distributed across the computing devices **1400 a**, **1400 b**, and **1400 c** based at least in part on the processing requirements for functions of activity assistant server **1308** and/or building occupant account server **1302**, the processing capabilities of the computing devices **1400 a**, **1400 b**, and **1400 c**, the latency of the local cluster networks **1412 a**, **1412 b**, and **1412 c** and/or of the wide area network connections **1413 a**, **1413 b**, and **1413 c**, and/or other factors that can contribute to the cost, speed, fault-tolerance, resiliency, efficiency, and/or other design goals of the overall system architecture.

Additionally, the configuration of the cluster routers **1411 a**, **1411 b**, and **1411 c** can be based at least in part on the data communication requirements of the computing devices and cluster storage arrays, the data communications capabilities of the network equipment in the cluster routers **1411 a**, **1411 b**, and **1411 c**, the latency and throughput of the local cluster networks **1412 a**, **1412 b**, **1412 c**, the latency, throughput, and cost of the wide area network connections **1413 a**, **1413 b**, and **1413 c**, and/or other factors that can contribute to the cost, speed, fault-tolerance, resiliency, efficiency and/or other design goals of the system architecture.

FIG. **29A** is a block diagram illustrating features of a building occupant interface, according to an example embodiment that is with one or more switch terminals **12**. In particular, activity-assistant building occupant interface **1500** may be displayed via one or more switch terminals **12**,

and may allow a building occupant to interact with an activity assistant. While only one screen of the activity-assistant building occupant interface **1500** is shown, it should be understood that the activity-assistant building occupant interface may include other screens, which provide additional functionality, without departing from the scope of the invention. As shown, activity-assistant building occupant interface **1500** includes a personalized activity panel, an activity feed that displays activities that have been added, done, and/or recently updated by friends of the building occupant (or members of the building occupant's social graph and/or social network), a search/add bar **1506**, and a context panel. Further, context panel includes a number of input mechanisms **1510 A-C** via which a building occupant can input context signals.

In one embodiment an auditory response of one or more switch terminals **23** and/or system **10**, interfaces or switch terminal system, display screen **48**, interface **20**, as well as context panel provides an interactive mechanism for building occupants to provide context signal data that describes a "building occupant context" (e.g. to provide signals indicative of the building occupant's intent, interest, mood, state-of-mind, experience, perception, associations with other building occupants, etc.). In the illustrated example, input mechanism **1510A** on the left of context panel allows a building occupant to signal their mood (e.g., "up for anything", "lazy", "productive", "social", etc.). The input mechanism **1510B** in the center of context panel allows a building occupant to signal a location (e.g., "current location", "home", "work", "stadium", etc.). Further, input mechanism **1510C** on the right of context panel allows a building occupant to signal a time or timeframe (e.g., "now", "tomorrow", "tonight", "next Wednesday morning", "2:00 AM CST", "9:00 PM EST on Saturday", etc.). Other input mechanisms are possible as well.

While the context information provided via the input mechanisms of the context panel such as one or more switch terminals **12** may be referred to as "signals" from the building occupant, it should be understood that, programmatically, this information may take the form of building occupant-specific parameters that are associated with the building occupant's activity account. As such, the data provided via input mechanisms **1510 A-C** may be stored in a building occupant-account database. For example data from input mechanisms **1510 A-C** may be stored as building occupant-specific parameters in building occupant-account database **110**. It is also possible that activity assistant server **108** may be fed data or may pull data directly from input mechanisms in real-time.

The context signal data acquired from the context panel (e.g., building occupant-specific parameters related to "building occupant context") may be combined by the activity assistant (e.g., activity-assistant server **108** and/or activity content server **102**) with global parameters of a given activity, other building occupant-specific parameters, and/or data from other sources, in order to derive signals indicative of activity-importance of the given activity to the building occupant. In this context, the "signals" are the information relative to the importance of the activity that is derived from the data (e.g., the building occupant-specific parameters, global parameters, etc.). As such, the activity assistant may interpret a building occupant-parameter as a signal in and of itself.

For instance, the building occupant's mood (provided via input mechanism **1510A**) may be interpreted as a signal that makes any number of activities more or less important for the building occupant. As a specific example, if the building

occupant's mood is "lazy", the activity "watching a movie" may become more important than it otherwise would be (as global parameters may indicate that "lazy" is a mood associated with the "watching a movie" activity). On the other hand, the activity "go to the gym" may become less important than it otherwise would be (as global parameters of "watching a movie" do not typically include "lazy" as an associated mood, or may in fact indicate that "lazy" is a mood that is likely incompatible with this activity).

The activity assistant may also derive more complex signals by evaluating the relationships and/or interactions between building occupant-specific parameters, global parameters, and/or other data items. To provide an example, a building occupant may have provided a "love being outdoors" signal, which may be stored in the building occupant's account as a building occupant-specific parameter (note that a building occupant interface input mechanism not shown on the screen **1500**, but is contemplated as being available). At a given point in time, the building occupant also may have set their mood to "active" via input mechanism **1510A**, set their location to "current location" via input mechanism **1510B**, and set their time to "tomorrow afternoon". The activity assistant may interpret this data as including a signal that the building occupant would like to do something active tomorrow afternoon at the same place they are currently located.

Further, the activity assistant may use other data sources to determine other relevant signals, such as the weather forecast for the next day at the building occupant's current location or the location that the building occupant will likely be at the next day. Tomorrow afternoon's weather forecast may thus be a signal, which can be combined with the signal derived from the building occupant-specific parameters to provide a more-refined signal that, for example, outdoor fitness or sporting activities near the building occupant's location should always be favored over indoor fitness or sporting activities near the building occupant's location, unless the tomorrow afternoon's forecast is for rain, in which case the amount by which outdoor activities are favored over indoor activities may be reduced (or indoor activities may actually be favored). For instance, combining all of this information, the activity assistant may increase the importance of active outdoor activities (e.g., "go for a run", "play flag football", etc.) to a greater extent when the forecast is for sunny weather, than when the forecast is for rain or snow.

The activity assistant may apply signal-based techniques, such as those described herein, to assess activity-importance for a number of activities and the importance of these activities relative to one another. This technique may be employed to provide the building occupant with various functions that are tailored to the building occupant's context.

For example, personalized activity panel **1502** may display intelligently selected and ordered activities from a pool of activities including the activities a building occupant has added to their account and suggested activities that have been selected for a building occupant. For example, a number of suggested activities may be determined based on factors such as building occupant preferences, signals from the context panel, and global parameters of potential activities, activities that have been added and/or done by friends of the building occupant, and/or activities that have been added and/or done by the building occupant in the past, among others. These suggested activities may then be combined with the activities a building occupant has already added to create a pool of potential activities for the personalized activity panel **1502**. Then, to determine which specific

activities to display in personalized activity panel **1502**, the activity assistant may quantify the importance of each activity (e.g., by evaluating signals for each activity), so that the activities that are most important to the building occupant are displayed.

Note that personalized activity panel **1502** that can be included in system **10**, switch terminals **12** and the like, may visually differentiate between activities that a building occupant has already added to their account, and suggested activities. For example, the “Watch Movie” activity is displayed with a dark background and white text to indicate that it is a suggested activity (and that the building occupant may thus wish to add it), whereas the other activities listed in personalized activity panel **1502** all have a white background with black text, thus indicating that the building occupant has already added these activities.

Further, the evaluation of importance may also be applied in the process of determining which activities should be displayed in the activity feed (and possibly the order in which those activities are displayed). In particular, a certain number of the most recently-added and updated activities may be evaluated based on signals such as those described above, and the most important of the recent activities may be displayed (possibly in the order of importance. Alternatively, it should be understood that activity feed may simply display activities in a time-wise manner as they are added/updated/completed, without adjusting based on the building occupant’s context. In a similar manner, search results (not shown) for an activity search via search/add bar **1506** may be displayed based at least in part on importance of the activities located in the search, or may simply be displayed in an order according to one of the many well-known search techniques.

FIG. **29B** is another block diagram illustrating features of a building occupant interface, according to an example embodiment. As a non-limiting example FIG. **29B** illustrates an alternative activity-assistant building occupant interface, which may be displayed via a client device once a building occupant has logged in to their activity-assistant account. Activity-assistant building occupant interface includes some of the same UI elements as activity-assistant building occupant interface of FIG. **29A** (e.g., search/add bar **1506** and context panel including a number of input mechanisms **1510** A-C). In one embodiment activity-assistant building occupant interface **1550**, such as display screen **54**, interface **20** and the like, can include an activity list and a suggested activity list.

In this embodiment, activity list may include only activities that a building occupant has added to their account. Thus, by evaluating signals for each activity a building occupant has added to their account, the activity assistant can determine which activities should be displayed in activity list (and the order in which those activities should be displayed).

Furthermore, suggested activity list may display only suggested activities (which have not yet been added by the building occupant.) Accordingly, the importance of specific activities may also be a factor in the process of determining which activities should be displayed in the suggested activity list (and the order of those activities).

FIG. **30** is flow chart illustrating a method according to an example embodiment. In particular, method **1600** may be carried out by an activity assistant in order to facilitate dynamic and flexible and activities. For example, activity assistant server **108** and/or building occupant account server **1302** of FIG. **27** carries out a method such as method **1600** to facilitate dynamic building occupant interaction with

activities via an interface such as the activity-assistant building occupant interfaces of FIGS. **29A** and **29B** in some embodiments.

More specifically, method **1600** involves the activity assistant accessing a building occupant-account database and retrieving the one or more account-specific parameters of a selected building occupant account, as shown by block **1602**. The activity assistant then selects a next activity, as shown by block **1604**, and accesses a global activity database to retrieve the global parameters of a selected activity, as shown by block **1606**. Then, for the combination of the selected building occupant account and the selected activity, the activity assistant determines one or more signals based at least in part on the global parameters of the selected activity and the account-specific parameters of the selected building occupant account, as shown by block **1608**. Also as shown by block **1608**, each signal provides an indication as to the importance of the selected activity to the selected building occupant account. Accordingly, the activity assistant can then use the determined signals as a basis for determining the importance of the selected activity for the selected building occupant, as shown by block **1610**. The activity assistant then causes a graphical display to display one or more of the selected activities in an arrangement that is based at least in part on to the importance of the selected activities relevant to one another in some configurations.

With respect to any or all of the block diagrams and flow charts in the figures as discussed herein, each block and/or communication may represent a processing of information and/or a transmission of information in accordance with example embodiments. Alternative embodiments are included within the scope of these example embodiments. In these alternative embodiments, for example, functions described as blocks, transmissions, communications, requests, responses, and/or message may be executed out of order from that shown or discussed, including substantially concurrent or in reverse order, depending on the functionality involved. Further, more or fewer blocks and/or functions may be used with any of the ladder diagrams, scenarios, and flow charts discussed herein, and these ladder diagrams, scenarios, and flow charts may be combined with one another, in part or in whole.

A block that represents a processing of information may correspond to circuitry that can be configured to perform the specific logical functions of a herein-described method or technique. Alternatively or additionally, a block that represents a processing of information may correspond to a system, a segment, or a portion of program code (including related data). The program code may include one or more instructions executable by a processor for implementing specific logical functions or actions in the method or technique. The program code and/or related data may be stored on any type of computer readable medium such as a storage device including a disk or hard drive or other storage medium.

The computer readable medium may also include non-transitory computer readable media such as computer-readable media that stores data for short periods of time like register memory, processor cache, and random access memory (RAM). The computer readable media may also include non-transitory computer readable media that stores program code and/or data for longer periods of time, such as secondary or persistent long term storage, like read only memory (ROM), optical or magnetic disks, compact-disc read only memory (CD-ROM), for example. The computer readable media may also be any other volatile or non-volatile storage systems. A computer readable medium may

be considered a computer readable storage medium, for example, or a tangible storage device.

It should be understood that for situations in which the systems and methods discussed herein collect personal information about building occupants, the building occupants may be provided with an opportunity to opt in/out of programs or features that may collect personal information (e.g., information about a building occupant's preferences or a building occupant's contributions to social content providers). In addition, certain data may be anonymized in one or more ways before it is stored or used, so that personally identifiable information is removed. For example, a building occupant's identity may be anonymized so that the no personally identifiable information can be determined for the building occupant and so that any identified building occupant preferences or building occupant interactions are generalized (for example, generalized based on building occupant demographics) rather than associated with a particular building occupant.

Moreover, a block that represents one or more information transmissions may correspond to information transmissions between software and/or hardware systems in the same physical device. However, other information transmissions may be between software systems and/or hardware systems in different physical devices.

Referring to FIGS. 31 and 32 in one embodiment system 10 is configured to be coupled with a sensing module 1700 at the building 25. As non-limiting examples the sensing module 1700 can be at one or more switch terminals 12 or not included in a switch terminal 12. The system is coupled with a sensing module 1700 at the building, in response to authorization by at least one building occupant that is authorized to make modifications to the system 10 the sensing module 1700 is configured to monitor third party access to at least a portion of the building.

As non-limiting examples, the sensing module 1700 is at least one of: an optical sensor module, motion detection module, audio detection module or any other module capable of producing signals capable of deriving physical presence of bodies in a space.

These sensing modules can then be paired with programs running on locally the system 10, remotely in the cloud or in combination of the two, that allow an authorized occupant to define zones of a space, which could include one or more zones in that building that then may be defined as authorized or unauthorized for occupancy by a party other than the primary occupants of a building in combination with the sensing module 1700 and the programs combine to create an interior zone control system that is integrated into a switch terminal system 10, or a zone control capable switch terminal system 10.

In one embodiment the sensing module 1700 provides one or more signals to the interior zone control system that allows for those signals to be assessed and determined if the presence of a person in a controlled zone is authorized or not. If a signal is detected in a zone that is currently not authorized for third party occupants, zone control cable switch terminal system can send an alert to another system capable of responding to the unauthorized occupancy. One non-limiting embodiment of a system capable of responding to the unauthorized occupancy is a monitoring company which in response to an unauthorized third access to the building can alert the authorized occupants or a security provider including police enforcement. The monitoring company can be cloud based. Additionally the zone control capable switch terminal system 1700 provide one or more responses at the building 15 itself.

As non-limiting examples: one or responses is sent from the sensing module 1700 at the building in response to an unauthorized third access to the building; in response to the third party entering the building at least one of: a response is sent, no response is response, an alarm is activated, a building occupant is notified, and an ability is provided someone to talk through the device. In one embodiment the building systems can respond by activating lights or locking doors.

As non-limiting examples the imaging module is selected from at least one of: a camera 1712, an optical sensor, thermal camera and the like.

As non-limiting examples the imaging module is at least one of: one or more switch terminals 12, external to a switch terminal 12; at an interior of the building 25, at an exterior of building 25, and the like.

In one embodiment the sensing module 1700 is configured to provide communication with a communication device of a third party, including but not limited to a mobile device.

In one embodiment the sensing module 1700 is configured to define a safe zone in which a third party is allowed access to the building 25. As a non-limiting example an area of the safe zone can be created by one or more dwelling occupants or their designee. In one embodiment sensing module 1700 is coupled to and/or included in one or more switch terminals 12 or can be a device 18 in communication with one or more switch terminals.

In one embodiment the safe zone is delimited by one or more virtual fences 1714, 1716 and the like, which the occupant of the building 25 can define, and in the event the one or more virtual fences 1714 and 1716 are broken, different alerts can be activated, including but not limited a local alarm, notification to the occupants mobile device, vocal warning, a communication with authorities, and the like.

In one embodiment the one or more virtual fences are multi-layer fences that can define multiple concentric zones. This allows for tracking of the occupant, a non-occupant that is granted access to the building 25 by the occupant, including but not limited to a delivery person, housekeeper and the like. In one embodiment, the order in which concentric fences are broken allows tracking of a movement as either towards a door, or away from a door. As a non-limiting example breaking the first fence 1714 can result in a vocal warning, while breaking second fence 1716 can result in an alarm being activated, and breaking a third fence can result in a call to authorities. As a non-limiting

In one embodiment a bridge is included at the building 25. In one embodiment the third party access to the building 25 is multi-tiered. In one embodiment the third party access to the building 25 is selected from at least one of: only one time, multiple times, recurring times, set times, and changeable times. In one embodiment the third party access to the building 25 is revocable.

As non-limiting examples the third party access to the building 25 is access for at least one of: maintenance of the building 25, delivery and the pick-up of items to and from a building 25, services related to buildings 25 and building occupants, craftspeople services, housekeeping services, laundry and dry-cleaning, skilled laborers, unskilled laborers delivery people, childcare, pet sitting, pet training, delivery of packages and other items from a delivery companies, and delivery of household items including groceries.

As non-limiting example the third party is selected from one or more of: an individual, an organization, one with more than a single person; a corporation, a DBA, partner-

ship, an organization or corporation with multiple layers of management, and multiple layers of providers.

In one embodiment the third party is at least one of a corporation, a DBA, and a partnership. As non-limiting examples the third party grants building 25 access to one or more individuals that performs for at least one of: maintenance of the building 25, delivery and the pick-up of items to and from a building 25, services related to building 25 and building occupants, craftspeople services, housekeeping services, laundry and dry-cleaning, skilled laborers, unskilled laborers delivery people, childcare, pet sitting, pet training, delivery of packages and other items from a delivery companies, and delivery of household items including groceries. As a non-limiting example the third party can grant access to the building 25 to one or more of its employees, contractors and consultants.

In one embodiment a server, which can be cloud based, is configured to enables the occupant/or owner, or end-dwelling user of the building 25 to authorize third-party access to the building 25 without sharing their credentials. In one embodiment the server is configured to allow granting of building 25 access credentials to a third party secured access to a building 25 in a secure manner.

In one embodiment in response to a request by one or more building occupants of the building access tokens are issued to the third-party by the server with the approval of the occupant/or owner, or end-dwelling user of the building 25. As a non-limiting example in response to a request by the occupant/or owner, or end-dwelling user of the building 25 the access token provides access to a protected resource hosted by the server.

In one embodiment building 25 access is granted to third parties for a certain time of day/night. As a non-limiting example building 25 access is granted to third parties for a certain length of time.

Third party building 25 access can be provided to a service provider. The service provider can give building 25 access rights to a service provider associate in selected circumstances and instances. In one embodiment the building 25 access rights to the server provider are temporary rights to an individual that are revocable by the service provider or the occupant/or owner, or end-dwelling user of the building 25.

As a non-limiting example the sensing module 1700 is at or close to the building 25 to monitor or record third party secured access to a building 25, including entering or exiting the building 25. In one embodiment a date and time of the third party secured access to a building 25 is recorded.

In one embodiment the third party is an organization that sells products, goods or services. In one embodiment the third party is an organization that sells products, goods or services and provides delivery of the products, goods or services to the building 25. In one embodiment the organization grants access to the building 25 to one or more of its employees, contractors and consultants for delivery of the products, goods or services.

The foregoing description of various embodiments of the claimed subject matter has been provided for the purposes of illustration and description. It is not intended to be exhaustive or to limit the claimed subject matter to the precise forms disclosed. Many modifications and variations will be apparent to the practitioner skilled in the art. Particularly, while the concept "component" is used in the embodiments of the systems and methods described above, it will be evident that such concept can be interchangeably used with equivalent concepts such as, class, method, type, interface, module, object model, and other suitable concepts. Embodi-

ments were chosen and described in order to best describe the principles of the invention and its practical application, thereby enabling others skilled in the relevant art to understand the claimed subject matter, the various embodiments and with various modifications that are suited to the particular use contemplated.

What is claimed is:

1. A system for using a first switch terminal of a building occupied by one or more building occupants, comprising:
 - a first switch terminal positioned at a first location of the building;
 - a first computer system included as part of the first switch terminal at a first location of the building;
 - a first plurality of sensors included as part of the first switch terminal, at least a portion of the sensors provide signal data to the first computer system, the first computer system producing a command or data output that relates to at least one of: a command output for a local control system, a command output for a different system, a data output for a different system, a command output for a non-local device or a data output that is a non-local device;
 - a second switch terminal that includes a second plurality of sensors coupled to a second computer system, the second switch terminal positioned at a second location of the building, coupled to and interacting with the first switch terminal to coordinate their operations and provide that the second switch terminal supplements information obtained from the first switch terminal;
 - an interface included with the first switch terminal to receive a command input from a building occupant and serves as a point of interaction between the first computer system and the building occupant, the interface selected from at least one of: touch, graphics, sound, position movement, voice, communication, wireless, and radio; and
 - the first and second switch terminals allowing a building occupant to utilize the first or second computer systems as a computer.
2. The system of claim 1, wherein the sensing module is at least one of: an optical module, motion detector, and audio module.
3. The system of claim 1, wherein one or responses more signals from the sensing module is received at a monitoring company in response to an unauthorized third access to the building.
4. The system of claim 1, wherein one or responses is sent from the sensing module at the building in response to an unauthorized third access to the building.
5. The system of claim 1, wherein in response to the third party entering the building at least one of: a response is sent, no response is response, an alarm is activated, a building occupant is notified, and ability is provided someone to talk through the device.
6. The system of claim 1, wherein the imaging module is a camera.
7. The system of claim 1, wherein the imaging module is an op sensor.
8. The system of claim 1, wherein the imaging module is at one or more switch terminals.
9. The system of claim 1, wherein the imaging module is external to a switch terminal.
10. The system of claim 1, further comprising:
 - a bridge at the building.
11. The system of claim 1, wherein the third-party access to the building is multi-tiered.

12. The system of claim **1**, wherein the third-party access to the building is selected from at least one of: only one-time, multiple times, recurring times, set times, and changeable times.

13. The system of claim **1**, wherein the third-party access to the building is revocable.

14. The system of claim **1**, wherein the third party access to the building is access for at least one of: maintenance of the building, delivery and the pick-up of items to and from a building, services related to buildings and building occupants, craftspeople services, housekeeping services, laundry and dry-cleaning, skilled laborers, unskilled laborers delivery people, childcare, pet sitting, pet training, delivery of packages and other items from a delivery companies, and delivery of household items including groceries.

15. The system of claim **1**, wherein the third party is selected from one or more of: an individual, an organization, one with more than a single person; a corporation, a DBA, partnership, an organization or corporation with multiple layers of management, and multiple layers of providers.

16. The system of claim **1** wherein the third party is at least one of a corporation, a DBA, and a partnership.

17. The system of claim **16**, wherein the third party grants building access to one or more individuals that performs for at least one of: maintenance of the building, delivery and the pick-up of items to and from a building, services related to buildings and building occupants, craftspeople services, housekeeping services, laundry and dry-cleaning, skilled laborers, unskilled laborers delivery people, childcare, pet sitting, pet training, delivery of packages and other items from a delivery companies, and delivery of household items including groceries.

18. The system of claim **16**, wherein the third party can grant access to the building to one or more of its employees, contractors and consultants.

19. The system of claim **1**, wherein the server is configured to enables the occupant/or owner, or end-building user

of the to authorize third-party access to the dwelling via the intelligent door lock system without sharing their credentials.

20. The system of claim **1**, wherein the server is configured to allow granting of dwelling access credentials to a third party secured access to a dwelling in a secure manner.

21. The system of claim **1**, wherein in response to a request by the occupant/or owner, or end-dwelling user of the dwelling access tokens are issued to the third-party by the server with the approval of the occupant/or owner, or end-dwelling user of the dwelling.

22. The system of claim **21**, wherein in response to a request by the occupant/or owner, or end-dwelling user of the dwelling the access token provides access to a protected resource hosted by the server.

23. The system of claim **1**, wherein dwelling access is granted to third parties for a certain time of day/night.

24. The system of claim **1**, wherein dwelling access is granted to third parties for a certain length of time.

25. The system of claim **1**, wherein dwelling access is provided to a service provider.

26. The system of claim **25**, wherein the service provider gives dwelling access rights to a service provider associate.

27. The system of claim **26**, wherein the dwelling access rights to the server provider associated are temporary rights to an individual that are revocable by the service provider or the occupant/or owner, or end-dwelling user of the dwelling.

28. The system of claim **1**, wherein the imaging module is at or close to the dwelling to monitor or record a third party secured access to a dwelling, including entering or exiting the dwelling.

29. The system of claim **1**, wherein a date and time of a third party secured access to a dwelling is recorded.

30. The system of claim **1**, wherein a third party is an organization that sells products, goods or services.

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